Inventory of Amphibian and Reptile Species at Gettysburg National Military Park and Eisenhower National Historic Site

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Table of Contents

List of Figures

List of Tables

List of Appendices

Summary

We conducted an inventory of amphibians and reptiles at Gettysburg National Military Park (GETT) and Eisenhower National Historic Site (EISE) from March-November 1999 and 2000. Both parks are located in Adams County, south-central Pennsylvania. Forest, grassland, wetland, and riparian areas were sampled for presence, relative abundance, and distribution of amphibians and reptiles. We used visual-encounter surveys, coverboards, general searches, funnel traps, drift-fence arrays, pitfall buckets, turtle traps, and leaf litter bags in our inventory.

We had predicted 43 species of amphibians and reptiles to potentially occur at GETT and EISE. Of these predicted species, we observed 24 (56%) species at GETT and 10 at EISE, including five salamander species, nine frog and toad species, five turtle species, and five snake species. Another species, the northern leopard frog (*Rana pipiens*), was a new species record for GETT and Adams County.

The highest number of species were recorded via general searches, visual-encounter surveys (VES), coverboards, and calling surveys. Survey protocols with low or no success included funnel traps, drift-fence arrays, pitfall buckets, and leaf litter bags. Forested habitat yielded the greatest number of observations, whereas no individuals were observed in grassland habitat.

We recommend that five VES and coverboard sites be used to monitor population trends in redback salamanders (*Plethodon cinereus*). We also suggest that population trends of frogs and toads, aquatic and semi-aquatic species, and aquatic turtles be monitored via calling surveys, stream and wetland surveys, and trapping, respectively.

Acknowledgments

Funding for this project was provided by the National Park Service. We are extremely grateful for the cooperation of National Park Service personnel, especially H. Frost, J. Karish, R. Krichten, and C. Musselman. We especially appreciate the work provided by field assistants V. Sauter, R. Cronauer, P. Gipe, T. Leslie, D. Olexy, N. Piergallini, and M. Seman. Thanks are also extended to R. Cook, S. Droege, A. Hulse, B. Paulson, G. Rocco, and H. Tiebout for advice on sampling techniques and species identification.

Introduction

Several natural resource surveys and research projects have been initiated and completed at Gettysburg National Military Park (GETT) and Eisenhower National Historic Site (EISE) over the past 10 years. These projects have resulted in considerable information regarding the presence, abundance, and distribution of various taxa of plants and animals. With this information, park management has been able to make quality decisions on how certain actions might affect biodiversity and populations of specific species. Some groups of organisms, however, have been relatively neglected by the research thus far at GETT and EISE. In particular, little is known about amphibians and reptiles in the parks. Thus, the goal of this project was to inventory amphibians and reptiles in biotic communities of forest, grassland, wetland, and riparian areas at the parks.

Prior research projects in the parks have included amphibian and reptile sampling (Hulse 1989; Yahner et al. 1999), but those studies were more limited in scope than the present project. In addition, a woodlot potentially targeted for removal by the draft General Management Plan was surveyed for endangered or threatened vertebrate species (Van Fleet and Kirkland 1995). No state or federal threatened or endangered species of amphibians or reptiles are known to occur in the parks.

The specific objectives of this project were to (1) review existing literature and documentation of the National Park Service and other sources and develop a database for historic and potential occurrence of amphibians and reptiles at GETT, EISE, and adjacent areas of Adams County, (2) determine the presence, relative abundance, and distribution of amphibians and reptiles in forest, grassland, wetland, and riparian areas at GETT and EISE based on extensive field surveys, and (3) develop recommendations for ecological monitoring of amphibians and reptiles.

Study Areas

Gettysburg National Military Park and Eisenhower National Historic Site are located in Adams County, Pennsylvania, and comprise 1,511 ha and 279 ha, respectively. The topography of the parks consists mainly of rolling hills. The mean elevation in the parks is 168 m, and the highest point is Big Round Top (240 m) (Yahner et al. 1991). There are seven ponds and numerous wetlands within the federal lands, and four predominant drainages: Rock Creek, Plum Run, Willoughby Run, and Marsh Creek (at EISE).

Fifty percent (756 ha) of GETT is agricultural land (crop and pasture) and 36% (547 ha) is forested. The remaining 14% is comprised of maintained areas, residential areas, or other types of human-dominated landscapes (Yahner et al. 1991). Eighty-three percent (232 ha) of EISE is agricultural land, 3% is forested, and 14% includes maintained areas, residential areas, and other developed land. Crop species at the parks include barley, corn, hay, sorghum, oats, rye, soybeans, and winter wheat. Forested lands are primarily oak (*Quercus* spp.), hickory (*Carya* spp.), and tulip poplar (*Liriodendron tulipifera*) (Yahner et al. 1991; Storm et al. 1995).

Protocols

Vegetation cover types at GETT and EISE were previously inventoried and mapped (Yahner et al. 1991). These data are included in the Geographic Information Systems (GIS) layers used by personnel at the parks, along with data obtained from recent aerial photos and National Wetland Inventory maps (stored at the GIS office at GETT). Curt Mussleman, the park GIS specialist for GETT, provided a habitat cover map of GETT and EISE. This map delineated elevations and various forest, grassland, cropland, and riparian habitats and was used to place sampling sites across appropriate habitats in the parks.

We stratified the selection of primary sampling points for amphibians and reptiles into three habitat types: riparian, grassland (not grazed by cattle and mowed only once per year), and forest. Sampling points were placed within a defined habitat in order to simplify the analysis of trends in species richness and population abundance. Points in riparian habitat were chosen primarily for sampling of stream-dependent species (e.g., frogs); those in grassland were selected particularly for species more common in open areas (e.g., snakes) (Yahner et al. 2001). Most other terrestrial amphibians and reptiles were expected to occur at the forest points. Additionally, we surveyed wetland areas in the parks for amphibian and reptile species that breed or live in these habitats.

The selection of sampling points in riparian, grassland, and forest habitats was based on a stratified-random design. The number of points in each habitat type was relatively proportional to the area of each cover type in the parks. To identify potential sampling points, a grid (100 x 100 m) was generated and overlaid on the cover-type map of the parks. The grid was aligned with the intersections of the existing Universal Transverse Mercator (UTM) system. Each grid intersection point was considered a potential sampling point. Based on the set of points that fell within the habitat types, we randomly generated a list of potential sampling locations. Points that fell within 50 m of a habitat edge, road, or developed area or within 200 m of another sampling point were removed from consideration. Sites near edge were avoided because salamander populations have been shown to be negatively affected by edges up to 35 m into the forest interior (Geer 1997; DeMaynadier and Hunter 1998). Selection of a given point also was dependent on a site visit to ground-truth the information provided by the map. Points were located on the ground within an accuracy of less than 1 meter using a Trimble Pro XR Geographic Positioning System (GPS) unit. The resulting sampling point was then saved in the GPS and downloaded to a GIS file for future reference. When necessary, points were adjusted up to 20 m (by continuing along the route followed to arrive at the point) in order to avoid intersection with a trail. The final list of points included three in riparian, seven in grassland, and 27 in forest habitats (Figs. 1-2; Appendix A). A map of sampling points was provided to park staff for review prior to our sampling.

After we began sampling the points for amphibians and reptiles, we added four additional riparian points (Fig. 2; Appendix A), giving a total of 41 points. These points were selected because they provided what appeared to be ideal habitat for streamside salamanders, such as clear water and plenty of cover in the form of small (10-50 cm diameter) rocks. Although the initial three randomly selected riparian points did not contain these habitat features, we continued to sample them during the survey.

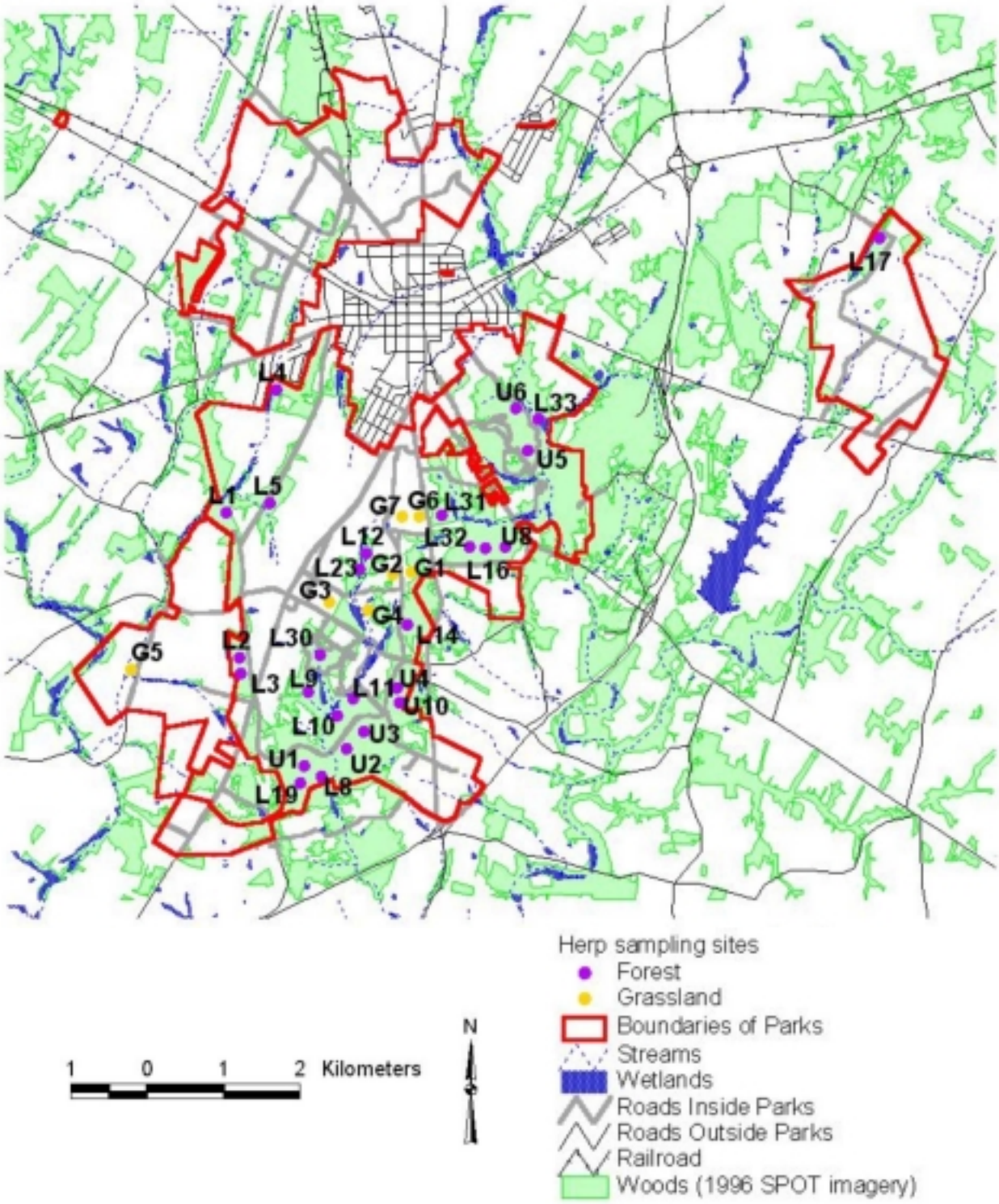


Figure 1. Map of Gettysburg National Military Park and Eisenhower National Historic Site, which was used for the selection of sampling points in forest and grassland in the amphibian and reptile inventory project (1999-2000). The locations of sampling points for visual encounter surveys and coverboard surveys are given, using a G to depict a grassland point (n = 7), a U for an upland forested point (n = 8), and an L for a lowland forested point (n = 18). The following sampling points were also used for the funnel trap protocol: L9, L14, L19, U4, U5, U8, R4, G1, G2, G5, G6, W5, and W14.

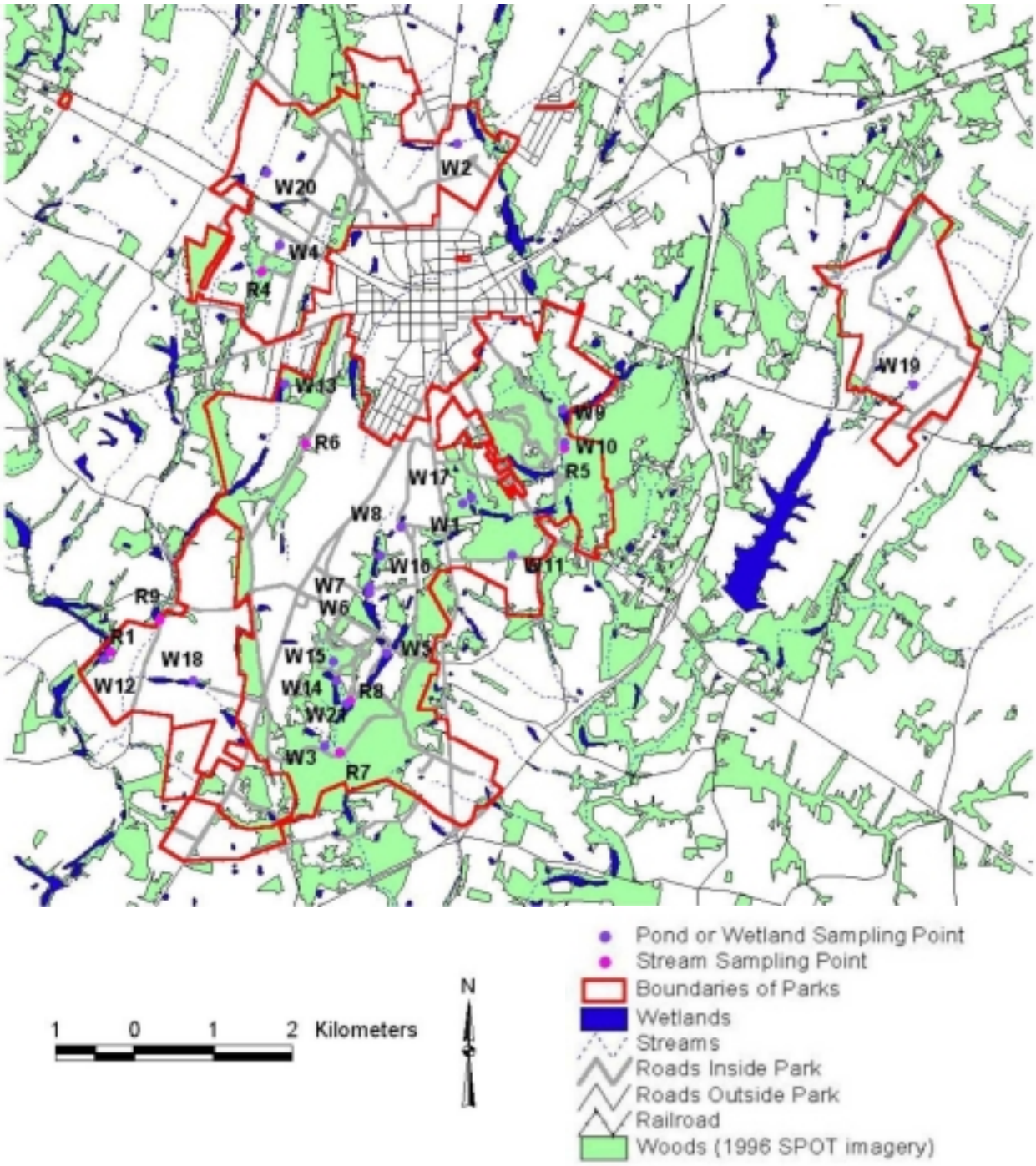


Figure 2. Map of Gettysburg National Military Park and Eisenhower National Historic Site, showing the location of wetlands and waterbodies surveyed for amphibians and reptiles (1999-2000). The locations of sampling points for visual encounter surveys and general searches are given, using a W to depict wetland points (n = 21) and an R for forested riparian points (n = 7).

Locations of wetlands for wetland and vehicular surveys were determined using the National Wetlands Inventory (NWI) map for the Gettysburg area (U.S. Dept. of the Interior 1982). All wetlands indicated on the map were visited to determine the presence of amphibians. Wetlands that contained amphibians were used to create a subset of 21 wetlands for use in wetland surveys and vehicular surveys; 19 of these were used as calling-survey points (Figs. 2-3; Appendix A).

We randomly selected two points each in riparian (the two were selected from the total seven riparian points), grassland, forest, and wetland habitats for terrestrial trapping in 1999. We also selected a total of three additional points for more intensive terrestrial trapping in 2000 in wetland, grassland, and forest habitats.

Historical and Predicted Species Data

As the first step in the completion of a biodiversity inventory, we developed a Microsoft Access database for the occurrence of historical and potential species at GETT and EISE (termed the Biodiversity Database). The file name for this database is GETTbiodiv.mdb and was given to the park with this report. This new database incorporated databases established previously, such as NPFauna and that resulting from Yahner et al. (1999). In addition, museums that could potentially have specimens from Adams County were contacted, and their records were searched. Reports from research projects associated with the parks were examined for information about species occurrences, and published literature was reviewed for descriptions of the distributions of herp species at GETT, EISE, and Adams County.

The Biodiversity Database gives the taxonomy of each species along with links from each species to the source of the information and the locations (GETT, EISE, Adams County) where the species was known to occur. This database was primarily used to assist with the design of the sampling scheme in this report. The usefulness of our Biodiversity Database has been replaced by the creation of NPSpecies in 2000. The NPSpecies database documents the occurrence of vertebrates and vascular plants in national parks based on data from a variety of resources, e.g., published reports and museum records. After examining records of vertebrates and plants that have historically occurred in the parks and comparing those records with current findings of inventorying and monitoring projects, park resource managers can formulate management plans for vertebrates and plants in each park.

At the completion of this project, we entered all species encountered in the parks into the NPSpecies database and referenced this report. In the NPSpecies database, there are three types of entries that can be made: 1) museum vouchers, 2) observations, and 3) references. Because our voucher photos were not prepared museum vouchers, we entered them as observations and noted in the comments field that they were voucher photos.

Sampling Strategy

Amphibians and reptiles as a group cannot be inventoried with a single survey protocol. Thus, we used a combination of survey techniques, with some taxa requiring special protocols for sampling (Yahner et al. 1999). After the first full year (1999) of sampling, we evaluated our results and modified the sampling strategy in an effort to expand the list of species encountered in the parks.

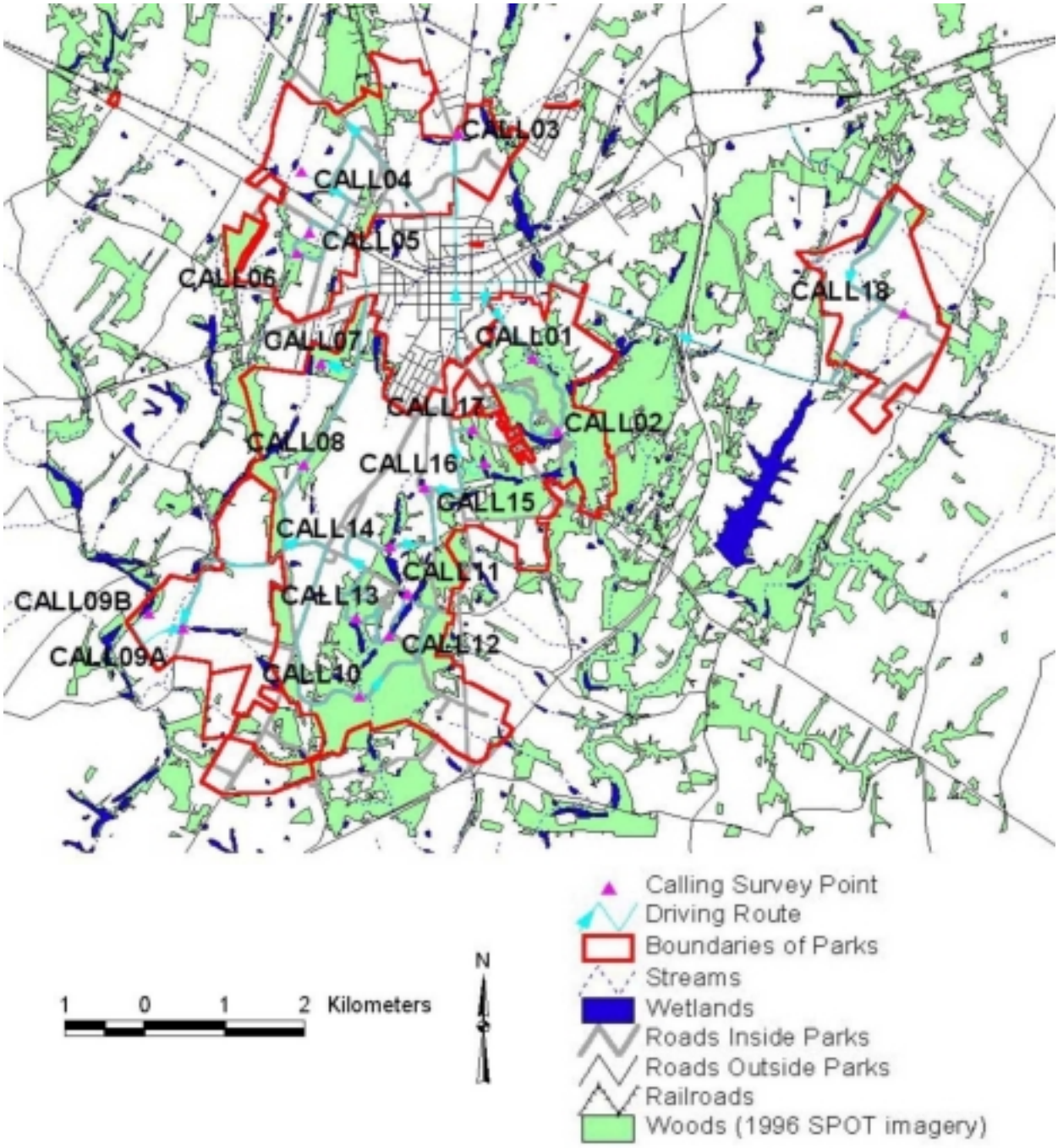


Figure 3. Map of Gettysburg National Military Park and Eisenhower National Historic Site, showing the travel route for vehicular surveys for pond-breeding amphibians (1999-2000). Arrows indicate direction of travel, and survey stops (n = 19) are marked.

Visual-Encounter Survey Protocol

Visual-encounter surveys (VES) were conducted at a series of sampling points (n = 33) distributed in forest habitat (Table 1; Fig. 1). On each forested sampling point, we centered a 15 m x 15 m plot for a VES (Fig. 4). The dimensions of the plot were arbitrarily determined, based on efficiency of sampling while encompassing as large an area as possible. At each riparian point (Fig. 2), we conducted a VES within 1 m of the stream bank on both the terrestrial side and the submerged side for a 100-m section along the boundary of a stream, using the sampling point as the upstream starting point (Table 1). A VES entailed a search beneath all substrates (including logs, coarse woody debris, and rocks) and on the leaf litter within the designated 15 m x 15 m plot or the 100 m x 2 m stream section and visually scanning the surface of the leaf litter (Yahner et al. 1999; Crump and Scott 1994). Rocks, logs, or coarse woody debris that would be impossible to lift or to replace in the same condition, such as very decayed logs, were not sampled for amphibians and reptiles. We recorded the time (minutes) that elapsed in the search, numbers of logs, coarse woody debris, and rocks turned; the species and numbers of animals encountered; and the substrate where each animal was found. Weather conditions, soil moisture, soil temperature, and soil pH were noted after conducting a VES. Within the 15- x 15-m plot, soil moisture and soil pH were noted by using a Kelway Soil pH and Moisture Meter (Genec, Inc., Montreal QC) and soil temperature was measured using a Weksler thermometer (Weksler Glass Thermometer Corporation, Boca Raton, Florida). A VES was conducted once per month in spring (March–May) and fall (September–November) 1999 and in spring 2000, as well as once in summer 1999, with at least 14 days between each survey (Table 1).

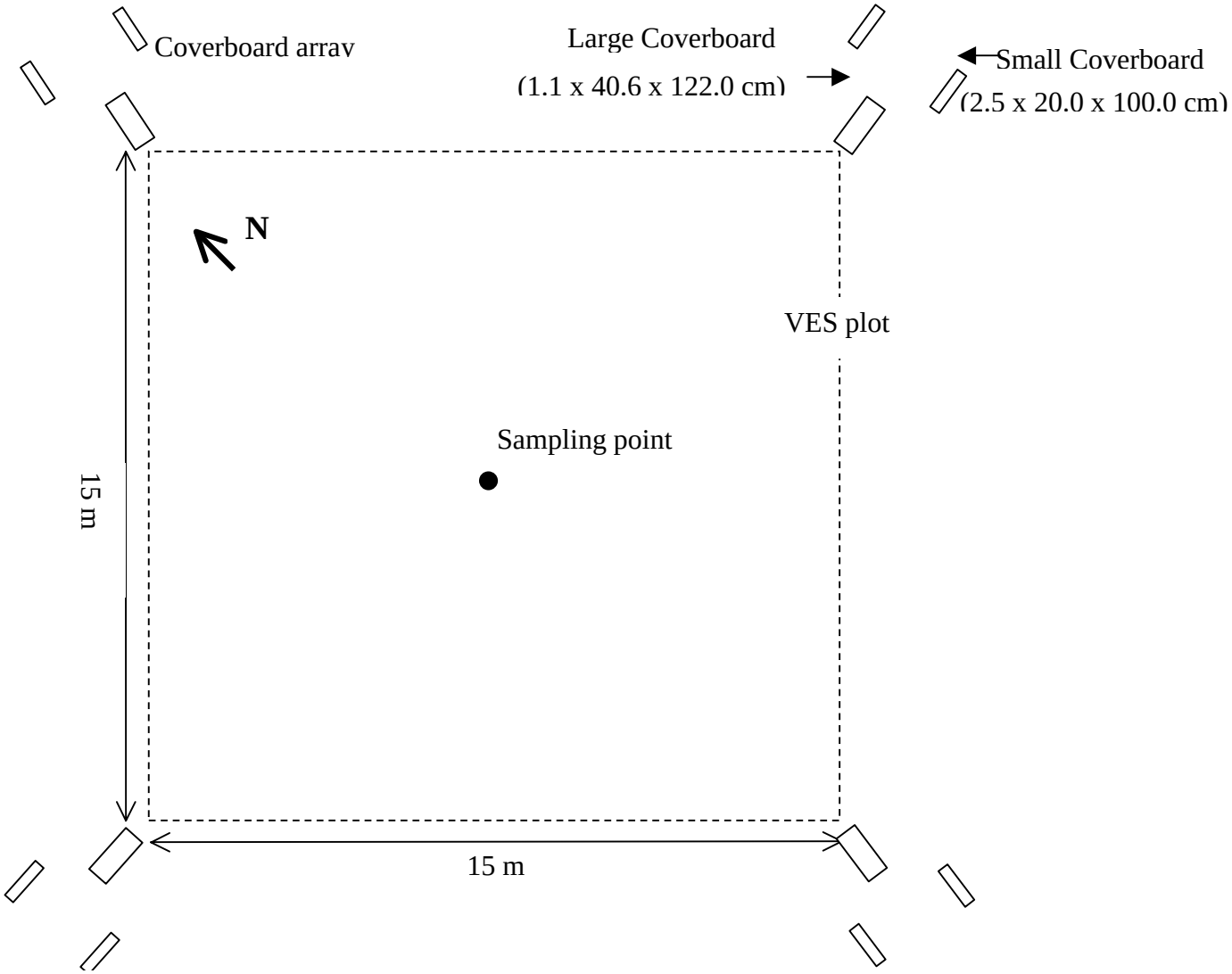
Coverboard Protocol

Coverboards have been shown to be an effective tool for inventorying and monitoring terrestrial salamanders and some reptiles (DeGraaf and Yamasaki 1992; Fitch 1992; Yahner et al. 2001). We placed coverboards at each forest and grassland sampling point in an array at the four corners of the 15- x 15-m plot centered on each sampling point (same plot used for VES in forested points, with additional plots established in grassland areas). Outside the edge of each corner, we placed one large coverboard (1.1 x 40.6 x 122.0 cm) at forest and grassland points and two small coverboards (2.5 x 20.0 x 100.0 cm) at forest points only (Fig. 4); boards were spaced approximately 0.5-m apart. We used pairs of small coverboards in order to minimize the effects of territoriality by salamanders, which can occur in high densities in forest habitats (Droege et al. 1997). Loose substrate (e.g., twigs, leaves, rocks) was cleared away beneath the boards, resulting in a board flush with the soil surface. Grasslands are typically not expected to contain terrestrial salamanders; therefore, we used only the large boards in grasslands in order to attract snakes. Boards were flipped, and an animal occurring underneath a board was identified to species and returned to the ground near the board in order to replace the board without crushing the animal (Yahner et al. 1999; Droege et al. 1997; Fellers and Drost 1994). A coverboard check was conducted once per month in spring and fall 1999 and in spring 2000 at the same time that a VES was conducted at a given point (Table 1). Additionally, grassland coverboards were checked once in summer (June–August) 1999 and 2000.

Table 1. Number of times each inventory protocol was used to sample amphibians and reptiles per season at Gettysburg National Military Park and Eisenhower National Historic Site, 1999-2000.

PROTOCOL	Spring 1999 (Mar, Apr, May)	Summer 1999 (June, July, Aug)	Fall 1999 (Sept, Oct, Nov)	Spring 2000 (Mar, Apr, May)	Summer 2000 (June, July)
Visual-encounter Surveys	3	1	3	3	0
Coverboards	3	1	3	3	1
Drift Fence Array	0	0	0	3	2
Funnel Traps	0	2	2	0	0
Turtle Traps	0	2	2	2	2
General Searches[1]	3	2	2	3	2
Calling Surveys	4	0	0	4	0

[1] This protocol includes egg mass searches of wetlands. For explanation of technique developed by Matt Laposata, Penn State Research Associate, see Protocol section of this report.



Note: the two small coverboards and one large coverboard within each coverboard array were positioned approximately 0.5 m from one another

Figure 4. Plot design for visual-encounter surveys (VES) and coverboard surveys at forested points for amphibians and reptiles at Gettysburg National Military Park and Eisenhower National Historic Site (1999-2000). Design for grassland points followed the same layout but without the small coverboards

Calling-Survey Protocol

We used additional protocols to sample wetlands where pond-breeding amphibians may be encountered. We established a road survey route for calling surveys in the park (Fig. 3). For conducting anuran calling surveys, 19 stops along a route were made where a road came within close proximity (50 m) of a wetland or stream (Yahner et al. 1999; Mertz 1996; Zimmerman 1994). Points were at least 0.8-km apart to avoid overlap of surveys.

While driving along the vehicular-survey route, an observer stopped at each predetermined point for an anuran calling survey (count of breeding amphibians calls). The count was conducted for 3 minutes, following a 1-minute equilibrium period. Surveys began 0.5 hours after sunset and were repeated four times in spring of 1999 on these dates: 3/24, 4/2, 5/5, and 6/8, and six times in spring of 2000 on these dates: 3/1, 3/9, 4/11, 4/19, 5/16, 6/8. The surveys began in March after the first warm ($>10^{o}$ C) day and ended in late June (Table 1). Several surveys were conducted because calls of each species of frog or toad peak at different times in the spring. Surveys were not conducted on rainy or windy (>16 km/h) nights. During each survey, species heard, relative abundance (1 = individual calls, 2 = distinguishable but overlapping calls, 3 = chorus), and weather conditions (e.g., wind velocity and percent clouds) were noted. Where stopping points were closest to vernal pools or culverts, we conducted a brief (2-5 minutes) visual search of vernal pool habitats.

General-Search Protocol

General searches were conducted by slowly walking and visually scanning for amphibians and reptiles in forest, grassland, and other habitats; if possible, logs or rocks were overturned and nets were used in water. We conducted general searches in all wetland habitats as well as along rock walls in grasslands in an attempt to encounter snakes and lizards. We searched rock walls that run approximately east-west in the morning, when reptiles were likely basking on the south-facing side of the wall to increase their body temperature. When amphibians and reptiles were observed, we documented the species and recorded the survey protocol as a general search.

General searches were commonly made at vernal pools, ponds, or other forms of standing water (e.g., culverts and slow seeps) (Fig. 2) to conduct egg mass surveys and scan the water for turtles or other amphibians in the spring breeding season. In deeper waters, e.g., ponds, we entered the water with hip waders and scanned the shoreline as well as the interior of the water body. Egg masses of three species of pond-breeding amphibians (wood frog [*Rana sylvatica*], Jefferson salamander [*Ambystoma jeffersonianum*], spotted salamander [*Ambystoma maculatum*]) can readily be identified to species. This technique is more consistent and reliable than sampling for larval amphibians later in the season (M. Laposata, Penn State Research Associate, March 1999). Each wetland was visited at least once per month from March-June 1999 and 2000 (Table 1). We recorded the time elapsed during the search, the number of egg masses by species, and the species observed.

Funnel Trap and Drift Fence Array Protocols

We used funnel traps, particularly as a means of capturing species of snakes and lizards that would not otherwise be encountered. In 1999, we used a simplified trapping protocol rather than drift-fence trap arrays typically used in amphibian, reptile, and mammal research (Corn 1994; Yahner et al.

1997). We used funnel traps instead of pitfall traps because funnel traps have been shown to be as effective as pitfalls, especially for capturing snakes, and are less disturbing to the substrate and less labor-intensive to establish than pitfalls (Brenner et al. 1992; Corn 1994; Greenberg et al. 1994; Enge 1997). Additionally, pitfall traps were largely unsuccessful at GETT and EISE in a prior study (Yahner et al. 1999).

Funnel traps were cylinders constructed of aluminum screening, 20 cm in diameter and 80 cm long, with funnel openings at both ends (Fitch 1951; Greenberg et al. 1994; Enge 1997). A wet sponge was placed inside each trap to prevent desiccation of animals, and a shade cover (WeedBlock premium landscape fabric, Easy Gardener, Inc., Waco, Texas) was placed over the interior of each trap. The funnel-trap protocol was not standardized because we were simply trying to increase the species list and experimented by placing traps in a variety of locations (Appendix B). In 1999, during each visit eight points were randomly chosen from these locations: L9, L14, L19, U4, U5, U8, R4, R5, G1, G2, G5, G6, W5, and W14 for funnel-trap placement. Each of these points was sampled at least once. In addition one and sometimes two areas of open fields with rock walls (Figs 1-2) were selected for funnel trap placement along potential travel corridors (e.g., rock walls, logs, or boulders) that served as natural drift fences (Fitch 1951, 1987). Traps were not placed within the 15- x 15-m area around the sampling point used for visual-encounter surveys and coverboards, but when in association with an established sampling point were distributed within a 40-m radius of the point. Traps were at least 5 m apart and were set out for 4 consecutive days and checked daily; all captured animals were immediately released. Trapping sessions were repeated once per month in June, July, September, and October 1999 (Table 1). We recorded trap location and species captured for each day.

The funnel traps had very little success in capturing amphibians and reptiles in 1999; therefore, we modified the terrestrial trapping scheme in 2000 by establishing a Y-shaped array of three drift fences to be used with the funnel traps (Fig. 5). These arrays were placed at sites in three different habitats where we expected high diversity of species based on inventory results from 1999 (Fig. 6). Each array was constructed of erosion cloth, staked out in three 10-m long fences, and stapled to the ground. We placed the funnel traps along the sides of the cloth and at the far end and anchored them to the fence. A pitfall trap was installed at the center of the Y-shaped array. The pitfall trap was a 5-gallon bucket sunk into the ground, leaving the rim flush with the surface. When opened, the lid for the bucket was propped above the rim with clothespins to serve as a rain cover. The lid was sealed on the bucket between trapping sessions. The bottom of the bucket contained a sponge and a cup with cotton as microhabitat refuges for amphibians and reptiles (or mammals). The bucket was equipped with drain holes in the event that water got inside the bucket. Arrays were placed within a 20-m radius of the 1999 sampling point in order to minimize interference with other sampling protocols. Trap arrays were opened and checked daily for 4 days per month from March-July 2000. Any animals captured were identified and released.

Turtle Trapping Protocol

We sampled aquatic turtles in sites at pond and stream habitats using baited turtle traps (Nylon Turtle Net, 2 ½ ft hoop diameter, 3 ½ in square mesh size, Nichols Net & Twine Co., Inc., Granite City, Illinois) (Appendix A; n = 35, points labeled as "Wetland/Stream," "Stream," "Pond," or

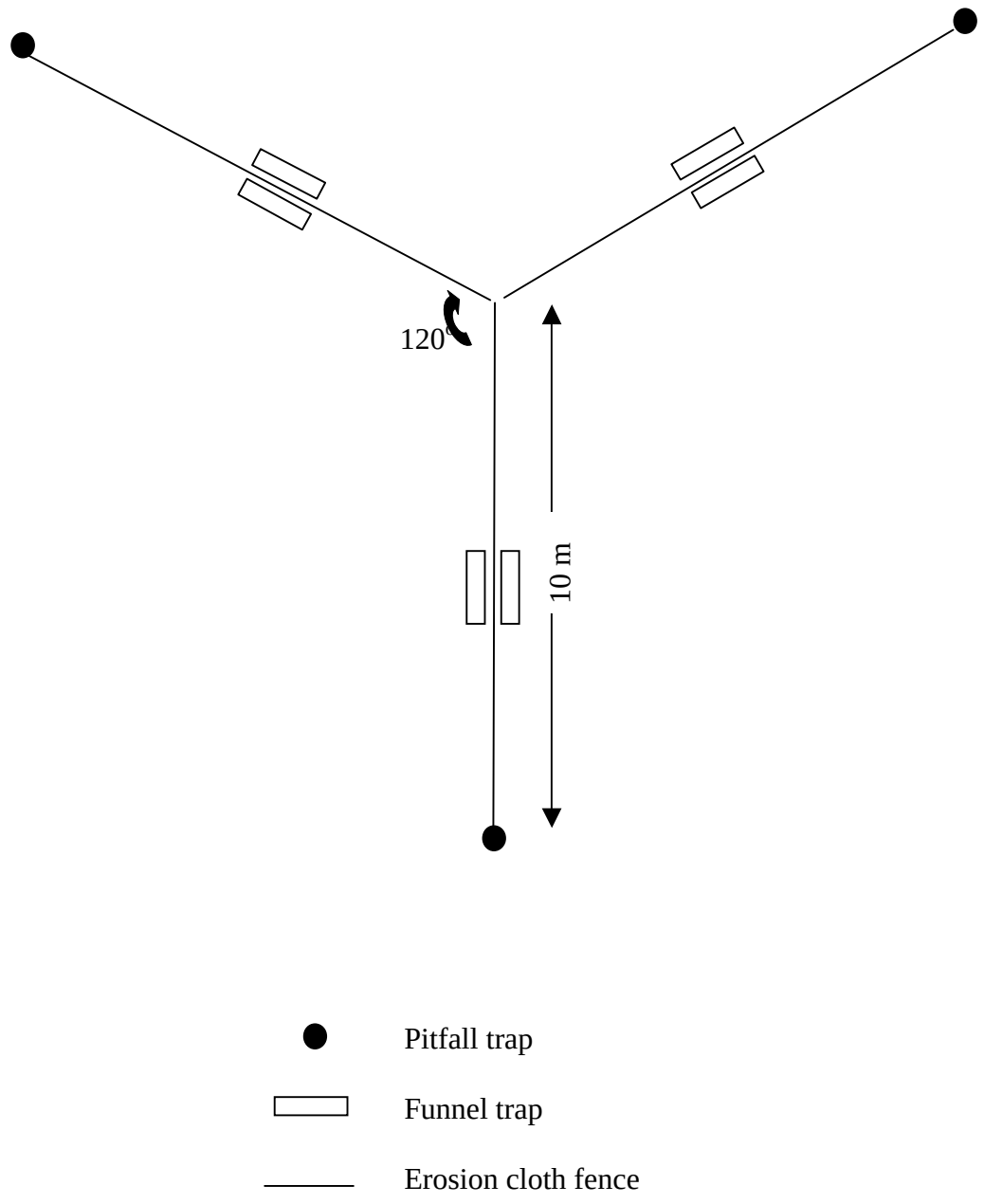


Figure 5. Schematic of the terrestrial-trapping array used for inventorying amphibians and reptiles at Gettysburg National Military Park, 2000.

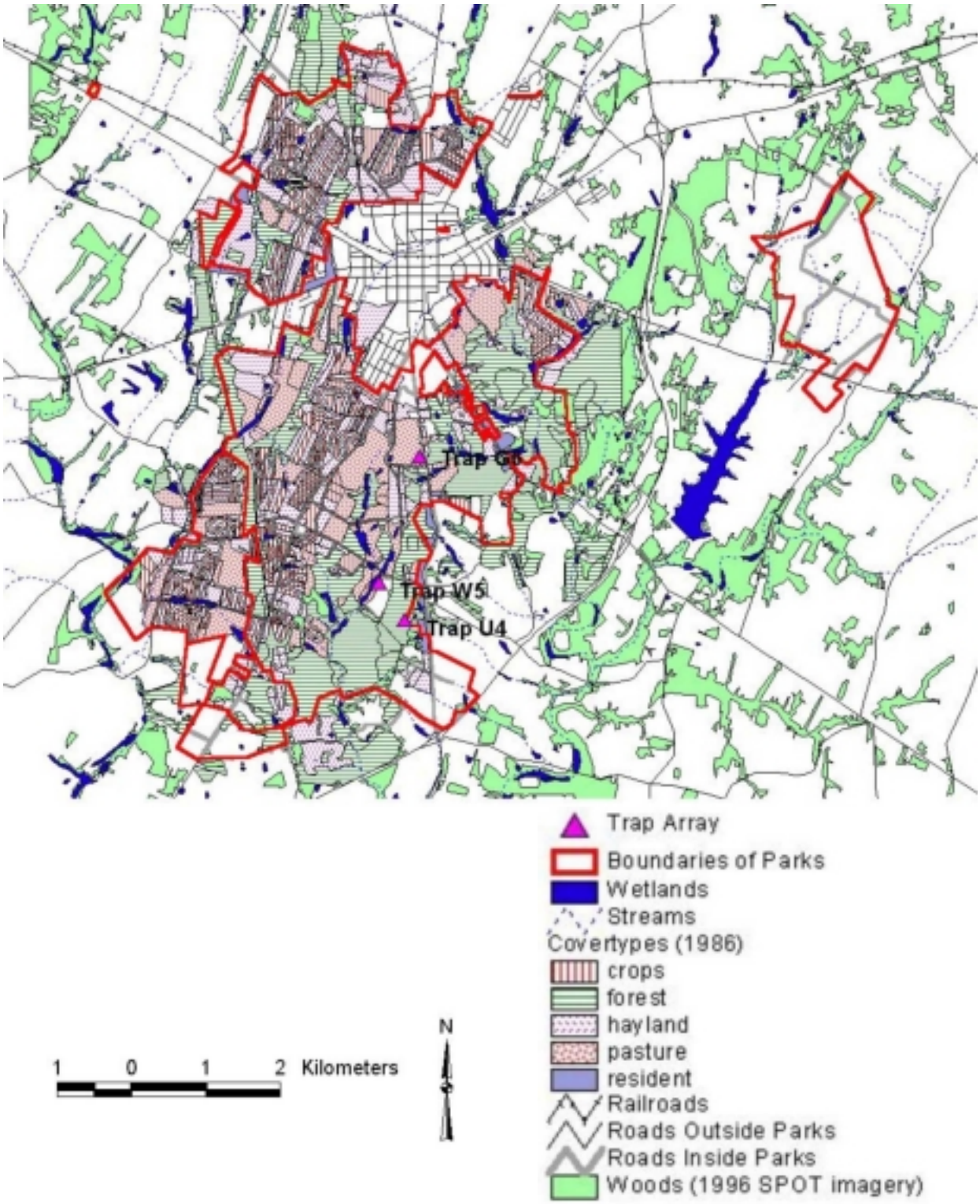


Figure 6. Map of Gettysburg National Military Park showing the location of three drift-fence trapping arrays used for terrestrial amphibian and reptile trapping in 2000.

"Pond/Stream" were sampled for aquatic turtles). Traps were baited with canned sardines or creamed corn (Plummer 1979). At each of the sites, we placed two to three turtle traps for 2-4 days (Appendix C). Trapping was conducted once per month in June, September, and October 1999 and from April-July 2000 (Table 1).

Traps were placed in shallow water so that at least 15 cm of the trap was above water to allow trapped turtles to breathe. Traps were checked and rebaited once a day during the trapping period. Captured turtles were identified to species and released. Because of the expense of traps, we could only trap three to four sites per month. Different sites were trapped each month in an attempt to cover all aquatic habitats likely to host turtles in the parks.

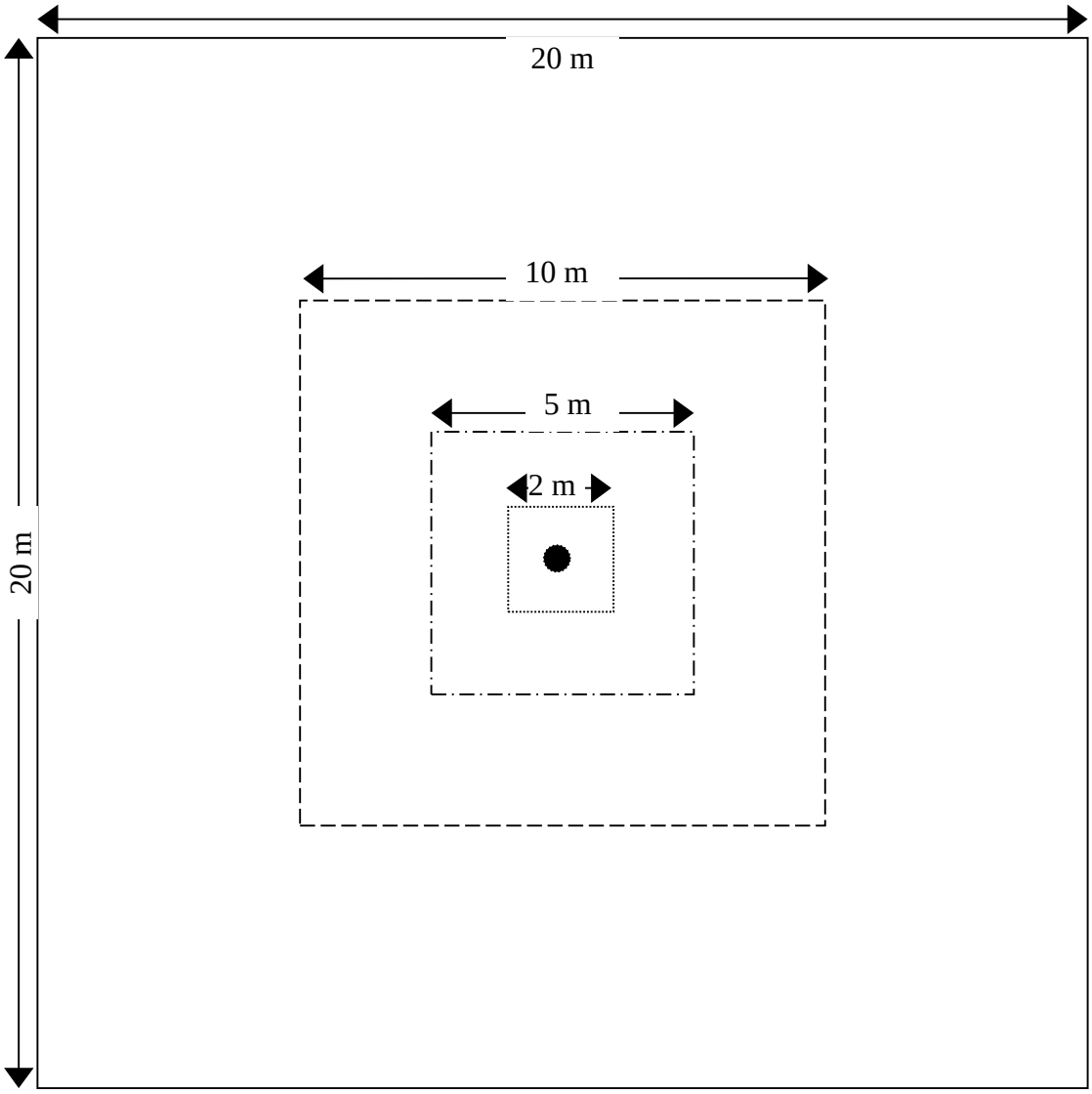
In 2000, we implemented another protocol of aquatic trapping using leaf-litter bags, which is a relatively new technique for inventorying and monitoring aquatic amphibians, especially salamander larvae (Jung et al. 1999). Leaf-litter bags were constructed of plastic netting (Deer Block 1.5 cm^2 mesh) cut into 50 cm^2 squares. Approximately 0.5 pounds of small rocks, leaves, conifer needles, and/or moss were placed in the center of the netting, and the sides were gathered together and cinched with a cable tie. The bags were placed in the water, surrounded by and topped with rocks, and then anchored with string to a nearby tree (after Jung et al. 1999).

When checking the bags, a dipnet was placed immediately downstream of the bag, and the rocks were carefully moved away (noting any amphibians under rocks). The bag was placed in a bucket of water and shaken to dislodge larval amphibians from the debris. The water in the bucket was then poured through the dipnet to capture any amphibians, and the leaf bag was replaced. Captured amphibians were identified to species and released downstream of the bag (after Jung et al. 1999). Advantages of this protocol are that there should be little observer bias (although identification of larval salamanders can be challenging to the average observer), it is easy to achieve large sample sizes, and there is very little disturbance to the site (Lannoo 1998).

In March 2000, we placed 34 leaf bags in streams and ponds at GETT and EISE. Leaf bags were checked in April and May. Nearly all bags placed in streams were either washed up on the bank or destroyed by floods, whereas the bags placed in ponds were silted over or left dry by receding waters. Leaf bags were removed in June and July because they were unsuccessful in attracting amphibians.

Vegetation sampling

We sampled the vegetation at each of the sampling points used for VES or coverboard sampling. Numbers and species of overstory trees, saplings, shrubs, herbaceous plants, and seedlings were sampled within each plot at all of the inventory sites based on protocols described by Russel et al. (1997) and Mahan et al. (1998; Fig. 7). Species and dbh (cm) of each overstory tree (>1.5 m high and $\geq$11.4 cm dbh) within the entire 20- x 20-m plot were recorded. Within a 10- x 10-m nested plot, number and species of each sapling (>1.5 m high and <11.4 cm dbh) or shrub (0.5-1.5 m high) were recorded. Within a 5- x 5-m nested plot, number and species of each herbaceous plant were recorded, and the percent cover of herbaceous plants, leaf litter, bare ground, woody debris, and rock was estimated to the nearest 5%. Finally, within a 2- x 2-m nested plot, the number and species of woody seedlings were recorded. For all plots, a plant was recorded in the plot if its stem originated on or



Overstory tree plot

Sapling and shrub plot

Herbaceous plant plot

Seedling plot

Sampling point

Figure 7. Plot design for vegetation sampling associated with amphibian and reptile sampling at Gettysburg National Military Park and Eisenhower National Historic Site, 1999-2000 (from Mahan et al. 1998).

within the plot boundaries. In addition, percent canopy cover, average slope, and aspect were recorded from the center of the sampling point.

Voucher Specimens

Amphibians and reptiles were not captured as voucher specimens in this project because it was intended as a low-impact inventory. Instead, color voucher photos were taken on slide film and given to the GETT resource management staff (Appendix D). Dead amphibians and reptiles were collected and preserved at the School of Forest Resources Vertebrate Museum, Penn State, for educational purposes; these specimens were assigned a unique identification number and a label, which included the collection permit number, locality where the specimen was collected, date the specimen was collected, collection protocol used, and name of collector. All catalogued specimens will be entered into a computer database for the Vertebrate Museum. The specimens will contain the park names in the labeling system and will be accessible for future reference and use.

Data Analysis

Data from the amphibian and reptile surveys were compiled to provide relative abundance, number of species observed, and distribution by park, study site, season, survey protocol, and habitat type. These data were entered into a Microsoft Access database as well as added to the Biodiversity Database where necessary to expand the species list in each park. Abundance (total number of animals) and relative abundance (abundance divided by the number of objects turned) of redback salamanders and other survey variables, such as the number of rocks and logs turned, were compared among sites using one-way analysis of variance (ANOVA) (Sokal and Rohlf 1995).

We did not develop a model for estimating species richness (Derge and Yahner 1998) in our project. The nature of this inventory was not compatible with the species richness models and daily or monthly inventories yielded very few species, which would violate many assumptions of the models.

Results

Amphibians and Reptiles

We predicted that 43 species of amphibians and reptiles occurred in the parks, but we recorded only 24 (56% of the total predicted) species in GETT; only 10 of the predicted species were recorded in EISE (Tables 2-3). These include five species of salamanders (45% of the total number of predicted salamanders), nine species of toads and frogs (90% of the total number of predicted toads and frogs), five species of turtles (63% of the predicted species of turtles), and five species of snakes (50% of the total number of predicted snakes and frogs). No species of lizards were encountered. An additional species, the northern leopard frog (*Rana pipiens*), was a new record for GETT and for Adams County.

The highest number of species were recorded via general searches (22 species), visual-encounter surveys (VES) (11 species), and calling surveys (9 species) (Table 4). With the exception of the grassland points (which yielded no encounters), one or more amphibian or reptile species was found under a coverboard at each point during at least one visit. In contrast, there were only four forest points that yielded no encounters using VES. Coverboard and VES protocols yielded the same number of species at all forest points combined; however, each protocol encountered three species not accounted for by the other protocol. Funnel traps and pitfall traps had very low success and did not capture any species that were not already documented by other protocols. Turtle traps were successful in capturing four of the six aquatic turtle species predicted to occur in the parks.

The redback salamander (*Plethodon cinereus*) was the most common species, with a total of 876 observations (66% of the total number of observations) accumulated from March-November 1999 and March-May 2000 with VES and coverboards (Table 5). This species also was captured once with a funnel trap (Table 4). The lead color phase of the redback salamander was more common (560 vs. 317) than the redback phase. Coverboards were equally as effective as VES in recording the presence of redback salamanders. Redback salamanders were ubiquitous throughout GETT and were even captured in a non-forested habitat (e.g., wetlands); however, mean abundance and mean relative abundance differed significantly among forest sites (1-way ANOVA; $P<0.000$, $df=26$, $F>9.2$; Appendix E). The highest abundances of redback salamanders were encountered in fall 1999, although mean abundance did not differ significantly among seasons (Table 6).

Two rocky sections of Plum Run (R7 and R8) consistently yielded observations of northern two-lined salamanders (*Eurycea bislineata*) and pickerel frogs (*Rana palustris*) during VES (Table 7). The next most commonly encountered species from VES at riparian points was the eastern American toad (*Bufo americanus americanus*), which was found primarily along north Willoughby Run (Table 7). The highest species richness was found at W5, 14, R7, and 9A, which yielded 14, 7, 6, and 6 species, respectively (Table 8).

The most abundant species encountered during general searches was the green frog (*Rana clamitans melanota*), followed by the pickerel frog. Both frog species were most numerous in Plum Run, particularly in the meadow at the Valley of Death.

Table 2. Species of amphibians and reptiles documented at Gettysburg National Military Park and Eisenhower National Historic Site using all inventory protocols and previous sightings, 1999-2000.

Park	Order	Family	Common Name	Scientific Name
GETT				
	Anura			
		Bufonidae		
			Eastern American Toad	*Bufo americanus americanus*
			Fowler's Toad	*Bufo woodhousei fowleri*
		Hylidae		
			Chorus Frog	*Pseudacris triseriata*
			Gray Treefrog	*Hyla versicolor*
			Northern Spring Peeper	*Pseudacris crucifer crucifer*
		Ranidae		
			Bullfrog	*Rana catesbeiana*
			Green Frog	*Rana clamitans melanota*
			Northern Leopard Frog	*Rana pipiens*
			Pickerel Frog	*Rana palustris*
			Wood Frog	*Rana sylvatica*
	Caudata			
		Ambystomatidae		
			Spotted Salamander	*Ambystoma maculatum*
		Plethodontidae		
			Northern Slimy Salamander	*Plethodon glutinosus*
			Northern Two-lined Salamander	*Eurycea bislineata*
			Redback Salamander	*Plethodon cinereus*
		Salamandridae		
			Red-spotted Newt	*Notophthalmus viridescens viridescens*
	Squamata			
		Colubridae		
			Black Rat Snake	*Elaphe obsoleta obsoleta*
			Eastern Garter Snake	*Thamnophis sirtalis sirtalis*
			Eastern Milk Snake	*Lampropeltis triangulum triangulum*
			Northern Ringneck Snake	*Diadophis punctatus edwardsii*
			Northern Water Snake	*Nerodia sipedon sipedon*
			Northern Black Racer[1,2]	*Coluber constrictor constrictor*
			Eastern Hognose Snake[2]	*Heterodon platirhinos*
	Squamata (cont'd)			
		Viperidae		
			Northern Copperhead[2,3]	*Agkistrodon contortrix mokasen*
			Timber Rattlesnake[2]	*Crotalus horridus*

Table 2, continued.

Park	Order	Family	Common Name	Scientific Name
GETT (cont'd)				
	Testudines			
		Chelydridae		
			Common Snapping Turtle	*Chelydra serpentina serpentina*
		Emydidae		
			Eastern Box Turtle	*Terrapene carolina carolina*
			Eastern Painted Turtle	*Chrysemys picta picta*
			Spotted Turtle	*Clemmys guttata*
		Kinosternidae		
			Common Musk Turtle	*Sternotherus odoratus*
EISE				
	Anura			
		Bufonidae		
			Eastern American Toad	*Bufo americanus americanus*
			Fowler's Toad	*Bufo woodhousei fowleri*
		Hylidae		
			Gray Treefrog	*Hyla versicolor*
			Northern Spring Peeper	*Pseudacris crucifer crucifer*
		Ranidae		
			Bullfrog	*Rana catesbeiana*
			Green Frog	*Rana clamitans melanota*
	Caudata			
		Plethodontidae		
			Northern Two-lined Salamander	*Eurycea bislineata*
	Squamata			
		Colubridae		
			Northern Black Racer[1]	*Coluber constrictor constrictor*
			Eastern Hognose Snake[2]	*Heterodon platirhinos*
		Viperidae		
			Northern Copperhead[3]	*Agkistrodon contortrix mokasen*
	Squamata (cont'd)			
		Viperidae		
			Timber Rattlesnake[2]	*Crotalus horridus*

Table 2 continued.

Park	Order	Family	Common Name	Scientific Name
EISE (cont'd)				
	Testudines			
		Chelydridae		
			Common Snapping Turtle	*Chelydra serpentina serpentina*
		Emydidae		
			Eastern Painted Turtle	*Chrysemys picta picta*
			Wood Turtle[4]	*Clemmys insculpta*
		Kinosternidae		
			Common Musk Turtle	*Sternotherus odoratus*

[1] Personal observation by Yahner et al. (1999).

[2] Wildlife Observation Card kept at GETT-EISE. Please note: the accuracy of these cards is questionable because they were made by people of unknown expertise (e.g., park visitor).

[3] Personal observation by Art Hulse, herpetologist at Indiana University of Pennsylvania.

[4] Documented by park staff.

Table 3. Species predicted and documented in an inventory of amphibians and reptiles at Gettysburg National Military Park and Eisenhower National Historic Site for each inventory protocol, 1999-2000. A "P" indicates predicted, a "D" indicates documented, shading further indicates that the species was documented during the inventory. The list of predicted species was obtained from previous studies, museum records for the county, and wildlife observation cards at the parks.

Scientific Name	Common Name	Visual Encounter Surveys	Coverboards	Funnel Traps	Drift Fence Arrays	Turtle Traps	Leaf Litter Bags	General Searches	Calling Surveys
Salamanders									
Ambystoma jeffersonianum	Jefferson Salamander	P	P		P			P	
Ambystoma maculatum	Spotted Salamander	P/D	P/D		P			P/D	
Desmognathus f. fuscus	Northern Dusky Salamander	P	P				P	P	
Eurycea bislineata	Northern Two-lined Salamander	P/D	P/D		P		P	P/D	
Eurycea l. longicauda	Long-tailed Salamander	P	P		P		P	P	
Gyrinophilus p. porphyriticus	Northern Spring Salamander	P	P				P	P	
Hemidactylium scutatum	Four-toed Salamander	P	P		P			P	
Notophthalmus v. viridescens	Red-spotted Newt	P	P/D		P		P	P/D	
Plethodon cinereus	Redback Salamander	P/D	P/D		P			P/D	
Plethodon glutinosus	Slimy Salamander	P	P/D		P			P	
Pseudotriton r. ruber	Northern Red Salamander	P	P					P	
Toads and Frogs									
Acris c. crepitans	Northern Cricket Frog	P	P	P	P			P	P
Bufo a. americanus	Eastern American Toad	P/D	P	P/D	P			P/D	P/D
Bufo woodhousei fowleri	Fowler's Toad	P	P	P	P			P/D	P/D

Table 3, continued.

Scientific Name	Common Name	Visual Encounter Surveys	Coverboards	Funnel Traps	Drift Fence Arrays	Turtle Traps	Leaf Litter Bags	General Searches	Calling Surveys
Toads and Frogs (cont'd)									
Hyla versicolor	Gray Treefrog	P		P	P			P	P/D
Pseudacris c. crucifer	Northern Spring Peeper	P	P	P	P			P/D	P/D
Pseudacris triseriata	Chorus Frog	P	P	P	P			P	P/D
Rana catesbeiana	Bullfrog	D			P			P	P/D
Rana clamitans melanota	Green Frog	P/D		P/D	P			P/D	P/D
Rana palustris	Pickerel Frog	P/D		P/D	P			P/D	P/D
*Rana pipiens**	Northern Leopard Frog			D	P			D	
Rana sylvatica	Wood Frog	P	P	P	P			P/D	P/D
Turtles									
Chelydra s. serpentina	Common Snapping Turtle			D	P	P/D		P/D	
Chrysemys p. picta	Eastern Painted Turtle			D	P	P/D		P/D	
Clemmys guttata	Spotted Turtle				P	P/D		P/D	
Clemmys insculpta	Wood Turtle	P		P	P			P	
Clemmys muhlenbergii	Bog Turtle				P	P		P	
Pseudemys rubriventris	Redbelly Turtle					P		P	
Sternotherus odoratus	Common Musk Turtle			D	P	P/D		P/D	
Terrapene c. carolina	Eastern Box Turtle	P/D		P	P			P/D	

Table 3, continued.

Scientific Name	Common Name	Visual Encounter Surveys	Coverboards	Funnel Traps	Drift Fence Array	Turtle Traps	Leaf Litter Bags	General Searches	Calling Surveys
Lizards									
Eumeces anthracinus	Coal Skink	P	P	P	P			P	
Eumeces fasciatus	Five-lined Skink	P	P	P	P			P	
Sceloporus undulatus hyscinthinus	Northern Fence Lizard	P	P	P	P			P	
Snakes									
Agkistrodon contortrix mokasen	Northern Copperhead	P	P	P	P			P	
Coluber c. constrictor	Northern Black Racer	P	P	P	P			P	
Crotalus horridus	Timber Rattlesnake	P	P	P	P			P	
Diadophis punctatus edwardsii	Northern Ringneck Snake	P/D	P	P	P			P	
Elaphe o. obsoleta	Black Rat Snake	P	P	P/D	P			P/D	
Heterodon platirhinos	Eastern Hognose Snake	P	P	P	P			P	
Lampropeltis t. triangulum	Eastern Milk Snake	P	P	P	P			P/D	
Nerodia s. sipedon	Northern Water Snake	P/D		P				P/D	
Opheodrys v. vernalis	Smooth Green Snake	P	P	P	P			P	
Thamnophis s. sirtalis	Eastern Garter Snake	P/D	P/D	P	P			P/D	
Total Number of Species Predicted		35	29	24	38	6	5	41	10
Total Number of Species Documented		11	6	8		4		20	9

* Not predicted, but documented; a new record for Adams County and GETT

Table 4. Species documented during the amphibian and reptile inventory at Gettysburg National Military Park and Eisenhower National Historic Site by survey protocol, 1999-2000.

Protocol	Order	Family	Common name
Visual-encounter Survey	Anura	Bufonidae	Eastern American Toad
		Ranidae	Green Frog
			Pickerel Frog
	Caudata	Ambystomatidae	Spotted Salamander
		Plethodontidae	Northern Two-lined Salamander
			Redback Salamander
	Squamata	Colubridae	Eastern Garter Snake
			Northern Ringneck Snake
			Northern Water Snake
	Testudines	Emydidae	Eastern Box Turtle
			Eastern Painted Turtle
Coverboard	Caudata	Ambystomatidae	Spotted Salamander
		Plethodontidae	Northern Slimy Salamander
			Northern Two-lined Salamander
			Redback Salamander
		Salamandridae	Red-spotted Newt
	Squamata	Colubridae	Eastern Garter Snake
Calling Survey	Anura	Bufonidae	Eastern American Toad
			Fowler's Toad
		Hylidae	Gray Treefrog
			Northern Spring Peeper
			Chorus Frog
		Ranidae	Bullfrog
			Green Frog
			Pickerel Frog
			Wood Frog
General Search	Anura	Bufonidae	Eastern American Toad
			Fowler's Toad
		Hylidae	Chorus Frog
			Northern Spring Peeper
		Ranidae	Bullfrog
			Green Frog
			Northern Leopard Frog

Table 4, continued.

Protocol	Order	Family	Common name
General Search (cont'd)	Anura	Ranidae	Pickerel Frog
			Wood Frog
	Caudata	Ambystomatidae	Spotted Salamander
		Plethodontidae	Northern Two-lined Salamander
			Redback Salamander
		Salamandridae	Red-Spotted Newt
	Squamata	Colubridae	Black Rat Snake
			Eastern Garter Snake
			Eastern Milk Snake
			Northern Water Snake
	Testudines	Chelydridae	Common Snapping Turtle
		Emydidae	Eastern Box Turtle
			Eastern Painted Turtle
			Spotted Turtle
		Kinosternidae	Common Musk Turtle
Funnel Trap	Anura	Bufonidae	Eastern American Toad
		Ranidae	Green Frog
	Caudata	Ambystomatidae	Spotted Salamander
		Plethodontidae	Redback Salamander
	Squamata	Colubridae	Black Rat Snake
	Testudines	Chelydridae	Common Snapping Turtle
		Emydidae	Eastern Painted Turtle
		Kinosternidae	Common Musk Turtle
Pitfall Trap	Anura	Bufonidae	Eastern American Toad
		Ranidae	Green Frog
			Northern Leopard Frog
	Caudata	Ambystomatidae	Spotted Salamander
Turtle Trap	Testudines	Chelydridae	Common Snapping Turtle
		Emydidae	Eastern Painted Turtle
			Spotted Turtle
		Kinosternidae	Common Musk Turtle

Table 5. Numbers of redback salamanders observed at 27 forest sampling points at Gettysburg National Military Park, 1999-2000, by protocol, color phase, and survey date. Individuals were not marked and may be represented more than once in the counts.

Protocol	Color Phase	All Months	Mar 99	Apr 99	May 99	Sept 99	Oct 99	Nov 99	Mar 00	Apr 00	May 00
Coverboard											
	Lead	294	13	22	14	31	47	56	53	39	17
	Redback	150	10	14	6	7	22	26	33	27	4
Total under coverboards		444	23	36	20	38	69	82	86	66	21
VES[1]											
Under rocks	Lead	171	4	15	8	17	43	25	30	27	2
	Redback	104	2	5	2	13	18	10	29	21	4
Total under rocks		275	6	20	10	30	61	35	59	48	6
Under logs	Lead	95	14	5	4	9	16	16	12	16	2
	Red	62	5	13	4	5	11	8	8	4	4
Total under logs		157	19	18	8	14	27	24	20	20	6
Total using VES		432	25	28	18	44	88	59	79	68	12
Total under coverboards and using VES		876	48	64	38	81	157	141	165	134	33

[1] VES = visual-encounter survey

Table 6. Mean (± *SE*) of variables measured during visual-encounter and coverboard surveys for amphibians and reptiles at Gettysburg National Military Park, 1999-2000. Date are combined over all 27 terrestrial survey points and calculated by season of survey (Spring = March-May, Fall = September-November). Abundance is defined as the total number of individuals encountered during a single visit; person-hours is the amount of time surveyed multiplied by the number of surveyors; objects is the number of logs, rocks, and coverboards turned in a survey; and relative abundance is the abundance divided by the number of objects.

Season	Abundance Redback Salamander	Person-hours Surveyed	Number of Objects Turned	Relative Abundance Redback Salamander
Spring 1999	2.0 ± 0.3	0.18 ± 0.01	42.4 ± 1.9	0.05 ± 0.01
Fall 1999	5.0 ± 0.7	0.22 ± 0.01	72.8 ± 3.6	0.07 ± 0.01
Spring 2000	4.2 ± 0.7	0.19 ± 0.01	73.0 ± 3.6	0.06 ± 0.01

Table 7. Mean (± *SE*) of abundance of the three most common species of amphibians and reptiles documented in visual-encounter surveys at stream sites in Gettysburg National Military Park and Eisenhower National Historic Site, 1999-2000. Abundance is defined as the total number of individuals documented during a single visit; person-hours is the amount of time surveyed times the number of surveyors.

			Abundance		
Site[1]	Number of Surveys	Person-hours Surveyed	Northern Two-lined Salamander	Eastern American Toad	Pickerel Frog
R1	7	0.30 ± 0.11	0.4 ± 0.4	0.0 ± 0.0	0.0 ± 0.0
R4	8	0.47 ± 0.16	0.0 ± 0.0	0.4 ± 0.2	0.0 ± 0.0
R5	5	0.22 ± 0.03	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0
R6	4	0.34 ± 0.07	0.0 ± 0.0	0.0 ± 0.0	0.3 ± 0.3
R7	9	0.66 ± 0.10	2.0 ± 0.8	0.1 ± 0.1	0.8 ± 0.5
R8	6	0.85 ± 0.18	3.3 ± 2.3	0.0 ± 0.0	0.7 ± 0.2

[1] See Appendix A for a description of these sites.

Table 8. Species of amphibians and reptiles documented at each survey site, protocols that yielded captures and the number of individuals associated with each successful protocol at Gettysburg National Military Park (GETT) and Eisenhower National Historic Site (EISE), 1999-2000. The number in parentheses after CS is a number that corresponds to calling survey codes (e.g., 1 = individual(s), 2 = overlapping, and 3 = chorus), not merely the number of individuals heard.

Park	Site[1]	Common Name	Protocol (number of individuals)[2]
GETT			
	01: East Confederate Ave 2nd Bridge		
		Northern Spring Peeper	CS (3)
	02: East Confederate Ave Spangler's Spring		
		Eastern American Toad	CS (1, 2)
		Northern Spring Peeper	CS (3)
	03: Barlow’s Knoll Pond from Farmhouse		
		Eastern American Toad	CS (1)
		Fowler's Toad	CS (1)
		Gray Treefrog	CS (1)
		Northern Spring Peeper	CS (2, 3)
	04: Buford Ave Corner		
		Eastern American Toad	CS (2)
		Gray Treefrog	CS (1)
		Northern Spring Peeper	CS (1, 2, 3)
		Green Frog	CS (1)
	05: Meredith Ave McPherson Quarry		
		Eastern American Toad	CS (1)
		Gray Treefrog	CS (1)
		Northern Spring Peeper	CS (2, 3)
	06: Meredith Ave Indiana Monument		
		Eastern American Toad	CS (3)
		Gray Treefrog	CS (1)
		Northern Spring Peeper	CS (1, 3)
	07: West Confederate Ave Youth Camp		
		Eastern American Toad	CS (3)
		Gray Treefrog	CS (2)
		Northern Spring Peeper	CS (1, 2, 3)

Table 8, continued.

Park	Site	Common Name	Protocol (number of individuals)
GETT			
	08: West Confederate Ave 2nd Bridge		
		Eastern American Toad	CS (2)
		Gray Treefrog	CS (1)
		Northern Spring Peeper	CS (1, 2)
	10: South Confederate Ave Plum Run		
		Eastern American Toad	CS (1, 2)
		Northern Spring Peeper	CS (1, 2, 3)
	11: Crawford Ave Plum Run		
		Chorus Frog	CS (1, 2)
		Eastern American Toad	CS (1, 2)
		Eastern Painted Turtle	PO (n = 1)
		Gray Treefrog	CS (1)
		Green Frog	CS (1)
		Northern Spring Peeper	CS (1, 2, 3)
		Pickerel Frog	CS (1)
	12: Crawford Ave Devil's Den		
		Green Frog	CS (1)
		Northern Spring Peeper	CS (1, 2, 3)
		Pickerel Frog	CS (1)
	13: Ayers Ave Bridge		
		Eastern American Toad	CS (2)
		Northern Spring Peeper	CS (1, 2, 3)
		Wood Frog	CS (1)
	14: US Ave Plum Run		
		Chorus Frog	CS (1)
		Eastern American Toad	CS (1, 2)
		Gray Treefrog	CS (1)
		Green Frog	CS (1, 2)
		Northern Spring Peeper	CS (1, 2, 3)
		Pickerel Frog	CS (1, 2)
		Wood frog	CS (1)
	15: Hancock Ave PA Monument		
		Eastern American Toad	CS (1, 2)
		Gray Treefrog	CS (1)
		Northern Spring Peeper	CS (1, 2, 3)

Table 8, continued.

Park	Site	Common Name	Protocol (number of individuals)
GETT			
	16: Middle Fantasyland Pond		
		Bullfrog	CS (1)
		Eastern American Toad	CS (1)
		Green Frog	CS (1)
		Northern Spring Peeper	CS (1, 2)
		Pickerel Frog	CS (1, 3)
	18: East Cavalry Field		
		Eastern American Toad	CS (2)
		Northern Spring Peeper	CS (3)
		Wood Frog	CS (1)
	IS7: Insect Sampling Site Codori-Trostle Thicket		
		Northern Leopard Frog	PO (n = 1)
	IW2: Insect Sampling Site Big Round Top		
		Eastern Box Turtle	PO (n = 1)
	IX1: Insect Sampling Site Big Round Top		
		Eastern Box Turtle	PO (n = 1)
	IX3: Insect Sampling Site Big Round Top		
		Eastern American Toad	PO (n = 2)
	IY2: Insect Sampling Site Big Round Top		
		Eastern Box Turtle	PO (n = 1)
	IY3: Insect Sampling Site Big Round Top		
		Black Rat Snake	PO (n = 1)
	IZ1: Insect Sampling Site Big Round Top		
		Northern Ringneck Snake	VES (n = 1)
	L1: Pitzer Woods		
		Redback Salamander	CB (n = 3), VES (n = 1)
	L10: Snyder Woods West		
		Eastern Box Turtle	VES (n = 3)
		Redback Salamander	CB (n = 10), VES (n = 13)
	L11: Snyder Woods East		
		Northern Ringneck Snake	VES (n = 1)
		Redback Salamander	CB (n = 2), VES (n = 10)

Table 8, continued.

Park	Site	Common Name	Protocol (number of individuals)
GETT			
	L12: Codori-Trostle Thicket North		
		Eastern Box Turtle	VES (n = 1)
		Eastern Garter Snake	CB (n = 1)
	L14: Sedgwick Ave		
		Redback Salamander	CB (n = 2)
	L16: Granite School House Lane West		
		Eastern Box Turtle	PO (n = 1)
		Redback Salamander	PO (n = 1), CB (n = 40), VES (n = 26)
	L17: Rummel Woods		
		Eastern Garter Snake	VES (n = 1)
		Redback Salamander	CB (n = 63), VES (n = 55)
	L19: Bushman Woodlot South		
		Redback Salamander	CB (n = 2), VES (n = 1)
	L2: Biesecker Woods North		
		Redback Salamander	CB (n = 12), VES (n = 10)
	L23: Codori-Trostle Thicket South		
		Redback Salamander	CB (n = 1)
	L3: Biesecker Woods South		
		Redback Salamander	CB (n = 16), VES (n = 3)
	L30: Sherfy Woods North		
		Northern Two-lined Salamander	CB (n = 1)
		Redback Salamander	CB (n = 8), VES (n = 1)
	L31: Guinn Woods		
		Redback Salamander	CB (n = 26), VES (n = 12)
	L32: Granite School House Lane East		
		Eastern Box Turtle	PO (n = 1)
		Eastern Garter Snake	VES (n = 1)
		Redback Salamander	CB (n = 27), VES (n = 15)
	L33: Culp’s Hill East		
		Redback Salamander	CB (n = 4)

Table 8, continued.

Park	Site	Common Name	Protocol (number of individuals)
GETT			
	L4: McMillan Woods		
		Eastern Garter Snake	CB (n = 2)
		Redback Salamander	CB (n = 73), VES (n = 3)
	L5: Spangler Woods		
		Eastern Garter Snake	VES (n = 1)
		Redback Salamander	CB (n = 10), VES (n = 2)
	L8: Bushman Woodlot East		
		Eastern Box Turtle	VES (n = 1)
		Redback Salamander	CB (n = 9), VES (n = 4)
	L9: Sherfy Woods South		
		Eastern Box Turtle	PO (n = 2)
		Redback Salamander	CB (n = 7)
	R4: Willoughby Run North		
		Bullfrog	GS (n = 1)
		Eastern American Toad	PO (n = 1)
		Northern Water Snake	GS (n = 1)
		Pickerel Frog	PO (n = 1)
	R5: Rock Creek		
		Green Frog	PO (n = 1)
		Pickerel Frog	PO (n = 1)
	R6: Tributary West Confederate		
		Pickerel Frog	VES (n = 1)
	R7: Plum Run South Confederate Ave		
		Eastern American Toad	VES (n = 1)
		Eastern Garter Snake	PO (n = 1)
		Green Frog	VES (n = 4)
		Northern Two-lined Salamander	VES (n = 27)
		Pickerel Frog	VES (n = 7)
	R8: Devil's Den		
		Green Frog	VES (n = 3)
		Northern Two-lined Salamander	VES (n = 23)
		Northern Water Snake	VES (n = 3)
		Pickerel Frog	VES (n = 6)
		Spotted Salamander	PO (n = 1), GS (n = 3)

Table 8, continued.

Park	Site	Common Name	Protocol (number of individuals)
GETT			
	TRAPU4: Forest Trap Array (Little Round Top)		
		Eastern American Toad	DF (n = 2)
		Green Frog	DF (n = 2)
		Northern Leopard Frog	DF (n = 1)
		Spotted Salamander	DF (n = 2), FT (n = 3)
	TRAPW5: Wetland Trap Array (Valley of Death)		
		Black Rat Snake	FT (n = 1)
		Redback Salamander	FT (n = 1)
	U1: Bushman Woodlot North		
		Eastern Box Turtle	PO (n = 1)
		Red-Spotted Newt	CB (n = 1)
		Redback Salamander	CB (n = 3), VES (n = 3)
	U10: Little Round Top North		
		Northern Ringneck Snake	VES (n = 1)
		Northern Slimy Salamander	CB (n = 1)
		Redback Salamander	CB (n = 45), VES (n = 71)
		Spotted Salamander	CB (n = 1), VES (n = 2)
	U2: Big Round Top West		
		Eastern American Toad	VES (n = 1)
		Redback Salamander	CB (n = 9), VES (n = 5)
	U3: Big Round Top East		
		Eastern Box Turtle	VES (n = 2)
		Redback Salamander	CB (n = 1), VES (n = 10)
	U4: Little Round Top South		
		Eastern American Toad	DF (n = 1)
		Red-Spotted Newt	CB (n = 1)
		Redback Salamander	CB (n = 20), VES (n = 84)
	U5: Culp’s Hill South		
		Redback Salamander	CB (n = 17), VES (n = 21)
	U6: Culp’s Hill West		
		Redback Salamander	CB (n = 14), VES (n = 59)
		Spotted Salamander	CB (n = 1)

Table 8, continued.

Park	Site	Common Name	Protocol (number of individuals)
GETT			
	U8: Powers Hill		
		Redback Salamander	CB (n = 20), VES (n = 26)
	W1: Guinn Woods Pools		
		Spotted Salamander	PO (n = 25)
	W10: Rock Creek Pools South		
		Spotted Salamander	PO (n = 1), GS (n = 11)
	W13: McMillan Woods Wetland		
		Redback Salamander	GS (n = 1)
	W14: Sherfy's Wetland or Electric Trolley Railbed (S. of Cross Ave) Wetland		
		Eastern Box Turtle	PO (n = 1)
		Green Frog	VES (n = 1)
		Pickerel Frog	VES (n = 1)
		Spotted Salamander	PO (n = 5), GS (n = 7)
		Wood Frog	PO (n = 1), GS (n = 2)
	W15: Electric Trolley Railbed (N. of Cross Ave) Pools		
		Spotted Salamander	PO (n = 1)
	W17: Middle Fantasyland Pond		
		Bullfrog	PO (n = 1)
		Common Snapping Turtle	TT (n = 3)
		Eastern Painted Turtle	PO (n = 3), TT (n = 6)
	W19: East Cavalry Field Stream and Pond		
		Green Frog	PO (n = 1)
		Northern Spring Peeper	GS (n = 1)
	W2: Barlow’s Knoll Pond		
		Eastern Painted Turtle	PO (n = 1), TT (n = 4), VES (n = 1)
		Fowler's Toad	PO (n = 1)
		Northern Water Snake	PO (n = 3)
	W20: Will’s / Winebrenner Farm		
		Bullfrog	PO (n = 1)
		Eastern Painted Turtle	TT (n = 1)
		Green Frog	PO (n = 1)

Table 8, continued.

Park	Site	Common Name	Protocol (number of individuals)
GETT			
	W21: West of Devil's Den		
		Redback Salamander	GS (n = 2), VES (n = 4)
		Spotted Salamander	
	W3: S. Confederate Ave (Wells Monument) Culvert		
		Green Frog	GS (n = 3), VES (n = 5)
		Northern Spring Peeper	GS (n = 1)
		Spotted Salamander	GS (n = 5), PO (N = 3)
	W4: McPherson Quarry		
		Eastern Painted Turtle	TT (n = 1)
		Green Frog	GS (n = 1)
		Northern Spring Peeper	GS (n = 1)
	W5: Plum Run / Valley of Death		
		Chorus Frog	GS (n = 1)
		Common Musk Turtle	FT (n = 1)
		Common Snapping Turtle	FT (n = 1), PO (n = 1), TT (n = 2)
		Eastern Milk Snake	GS (n = 1)
		Eastern Painted Turtle	FT (n = 1), GS (n = 2), PO (n = 2), TT (n = 3)
		Green Frog	FT (n = 10), GS (n = 5), PO (n = 3), VES (n = 1)
		Northern Leopard Frog	PO (n = 1)
		Northern Spring Peeper	GS (n = 2)
		Northern Water Snake	PO (n = 1)
		Pickerel Frog	GS (n = 6), PO (n = 4)
		Red-Spotted Newt	GS (n = 4), PO (n = 3)
		Spotted Salamander	GS (n = 320), PO (n = 55)
		Spotted Turtle	GS (n = 1), PO (n = 1), TT (n = 1)
		Wood Frog	PO (n = 1)
	W6: Althoff-Weikert Pond		
		Common Snapping Turtle	GS (n = 1), PO (n = 2)
		Green Frog	PO (n = 1)
		Northern Spring Peeper	GS (n = 1), PO (n = 3)
		Pickerel Frog	GS (n = 1), PO (n = 1)
		Spotted Salamander	PO (n = 25)
	W9: Rock Creek Pools North		
		Northern Spring Peeper	GS (n = 1)
		Redback Salamander	GS (n = 1)

Table 8, continued.

Park	Site	Common Name	Protocol (number of individuals)
EISE			
	09A: Red Rock Road Driveway / Bridge		
		Bullfrog	CS (1)
		Eastern American Toad	CS (3)
		Fowler's Toad	CS (1)
		Gray Treefrog	CS (1)
		Green Frog	CS (1)
		Northern Spring Peeper	CS (1, 3)
	09B: Marsh Creek from Farmfield		
		Eastern American Toad	CS (2)
		Fowler's Toad	CS (1)
		Northern Spring Peeper	CS (1)
	R1: Marsh Creek - EISE		
		Eastern American Toad	PO (n = 1)
		Northern Two-lined Salamander	VES (n = 3)
	R9: Willoughby Run South		
		Common Musk Turtle	PO (n = 1), TT (n = 2)
		Common Snapping Turtle	TT (n = 1)
		Eastern Painted Turtle	PO (n = 1)
		Green Frog	PO (n = 1)

[1] There are seven insect sampling sites included in this table (IS7, IW2, IX1, IX3, IY2, IY3, and IZ1). For a description of these insect sampling sites, see Kim, Derge, Grehan, and Withington. (2001). Inventory of invertebrates at Gettysburg National Military Park and Eisenhower National Historic Site, with special reference to forest removal. National Park Service, Technical Report. In Press.

[2] Protocols include: Calling surveys (CS), general searches (GS; includes egg mass searches of wetlands; for explanation of technique developed by Matt Laposata, Penn State Research Associate, see Protocol section of this report (p. 10-11)), personal observations (PO; incidental sighting; not a survey protocol), visual-encounter surveys (VES), coverboards (CB), funnel traps (FT), drift fence arrays (DF), and turtle traps (TT).

Forty-seven individual amphibians and reptiles were photographed for the voucher photo collection, representing 21 of the 25 species encountered in our study (Appendix D). Species not accounted for in voucher photos were Fowler's toad (*Bufo woodhousei fowleri*), chorus frog (*Pseudacris triseriata*), gray treefrog (*Hyla versicolor*), and northern spring peeper (*Pseudacris crucifer crucifer*); these five species were encountered only by hearing them in the calling surveys or, as in the case of the spring peeper, were too small to photograph successfully.

Only one specimen, a juvenile black rat snake (*Elaphe obsoleta obsoleta*), was collected and preserved as a result of the inventory. It was found dead in one of the funnel traps associated with a drift-fence array. It was placed in formalin and then stored in 70% alcohol in the Terrestrial Vertebrate Museum of the School of Forest Resources at Penn State.

Vegetation

We recorded 24 species of herbaceous plants and 28 species of woody seedlings in the plots used for coverboard and visual encounter survey protocols (Table 9; Appendices F and G). Also, 42 species of saplings and shrubs combined and 25 species of overstory trees were noted in these plots (Table 9; Appendices H and I).

Species Documented in the Parks During the 1999-2000 Inventory

Eastern American Toad (*Bufo americanus americanus)*

This species was common throughout the surveyed areas of both EISE and GETT. Full breeding choruses were documented in spring 1999 and 2000, and both juveniles and adults were commonly encountered during foot travel in the parks. Toads were encountered primarily in forest and riparian habitats. However, they are known to occur in a variety of habitats, from suburban areas to heavily forested regions, provided invertebrates and moisture are plentiful (Behler and King 1995).

Fowler's Toad (*Bufo woodhousei fowleri)*

This species was encountered only in Barlow's Knoll pond in GETT and along Willoughby Run and Marsh Creek in EISE. Breeding choruses were heard in all three locations, and one adult was captured at the pond. Kirkland (1996) found one Fowler's toad on Power's Hill. The Fowler's toad is commonly found on sandy soils near wetlands and in backyards (Behler and King 1995).

Chorus Frog (*Pseudacris triseriata)*

This species was heard calling only at GETT in the Valley of Death wetland along Plum Run during surveys in March and April 1999 and 2000. Efforts to capture a specimen for confirmation of species identity were unsuccessful. Defensive calls of the northern spring peeper are sometimes confused with those of chorus frogs, but we tape recorded the call for closer listening and were confident in our identification. The chorus frog can be found in grassy, woodland, and wetland habitats (Behler and King 1995).

Table 9. Mean (± *SE*) of vegetative characteristics measured at forested plots (n = 27) associated with visual-encounter and coverboard surveys at Gettysburg National Military Park, 1999-2000.

Variable	Mean ± *SE*
Number of overstory trees	15.15 ± 1.25
Species richness of overstory trees	5.89 ± 0.42
Average dbh of overstory trees	28.0 ± 1.25
% cover herbaceous plants	8.19 ± 1.97
Species richness herbaceous plants	4.37 ± 0.33
Number of seedlings	29.96 ± 3.79
Species richness of seedlings	6.52 ± 0.54
Number of shrubs	120.93 ± 13.66
Species richness of shrubs	8.15 ± 0.58
% canopy cover	77.78 ± 4.26
% rock ground cover	12.52 ± 3.51
% wood ground cover	5.11 ± 1.02
% leaf ground cover	36.15 ± 4.72
% vegetative ground cover	35.41 ± 3.98
% grass ground cover	9 ± 3.51
Mean soil temperature (^{o}C) (10 visits)	11.1 ± 0.3
Mean soil pH (10 visits)	6.6 ± 0.04
Mean soil moisture (%) (10 visits)	53.1 ± 1.1

Gray Treefrog (*Hyla versicolor)*

The gray treefrog was heard throughout both parks, particularly in 2000. None was captured because of difficulty in pinpointing habitat or location, as their song carries considerable distances and is hard to localize. The gray treefrog inhabits trees and shrubs in the vicinity of permanent bodies of water (Behler and King 1995).

Northern Spring Peeper (*Pseudacris crucifer crucifer)*

This species was heard in full choruses at nearly every aquatic location in both parks. As with the gray treefrog, it was difficult to pinpoint the habitat or location of the spring peeper because its song carries for great distances. Three individuals were captured in GETT: one in S. Confederate Ave. (Wells Monument) Culvert and two in grassland near Althoff-Weikert Pond. The northern spring peeper occupies forested habitat in or near wetlands (Behler and King 1995).

Bullfrog (*Rana catesbeiana)*

The bullfrog was commonly found at Fantasyland and near the former site of the National Tower in pond habitat; one was found on north Willoughby Run at GETT. This species can also be found around larger bodies of water, such as lakes and rivers (Behler and King 1995). The bullfrog likely occurs in EISE, although preferred habitats are few in this park.

Green Frog (*Rana clamitans melanota)*

The green frog was ubiquitous throughout stream and pond habitats of both parks. It was associated most often with ponds in open canopy areas, but some were also found in forested habitat. The green frog can be found in almost any wet area (Behler and King 1995).

Northern Leopard Frog (*Rana pipiens)*

The northern leopard frog was a new species record for Adams County and GETT (A. Hulse, Herpetologist at the Indiana University of Pennsylvania, August 2000). This species has a scattered occurrence in Pennsylvania, but is most common in the western third of the state. Two individuals were found in Plum Run, one in the Valley of Death wetland, and one in the Codori-Trostle Thicket at GETT. Evidence of breeding was indicated by the capture of a juvenile in a forested section of Little Round Top at GETT. None was heard calling. The northern leopard frog occupies a variety of habitats from wet areas to dry fields (Behler and King 1995).

Pickerel Frog (*Rana palustris)*

This species was ubiquitous throughout both open and closed canopy stream habitats at GETT. Although, this species was not found at any of the riparian, wetland, or calling locations at EISE, it is likely to occur in this park. Because the sites in EISE sufficiently met the requirements of other adaptable species (e.g., eastern American toad), then EISE probably does support pickerel frog populations. The other six species of frogs and toads found at the EISE sites (Appendix I) share similar habitat requirements with the pickerel frog (Shaffer 1991). The pickerel frog is

adapted to a variety of habitats, from aquatic (e.g., marshes, springs, and streams) to grassland (e.g., meadows and moist fields) (Shaffer 1991).

Wood Frog (Rana sylvatica)

The wood frog was uncommon, with one dead adult and two egg masses observed and four individuals heard singing. The presence of egg masses indicates that this species was breeding at GETT in at least two locations (Sherfy's Wetland/Electric Trolley Railbed (S. of Cross Ave.) Wetland and Plum Run/Valley of Death). Singing by wood frogs was heard at GETT at Ayers Avenue Bridge, U.S. Avenue Plum Run, and East Cavalry Field. Van Fleet et al. (1995) found five individuals of this species in the Codori-Trostle Thicket at GETT. The wood frog is commonly found in moist forested areas (Behler and King 1995). It is an explosive breeder and calls for a very short period early in spring. Thus, our calling surveys may have missed the peak of the calling period, thereby yielding fewer encounters than expected. However, the wood frog probably does not occur at EISE, as this park has little breeding habitat in the form of vernal pools.

Spotted Salamander (*Ambystoma maculatum)*

The spotted salamander was common at Little Round Top. Egg masses and breeding adults were found in almost all vernal pool and seep habitats in both open and closed canopy areas at GETT. The wetland along Plum Run in Valley of Death was the most common breeding area at GETT. General habitat requirements include upland and lowland forests with vernal pools (Petranka 1998). Because EISE lacks these habitats, the spotted salamander is unlikely to occur in this park.

Northern Slimy Salamander (*Plethodon glutinosus)*

The northern slimy salamander was uncommon. Only one was captured on Little Round Top at GETT. This species prefers rocky areas and moist woodland ravines and hillsides (Behler and King 1995), and thereby probably does not occur in EISE.

Northern Two-lined Salamander (*Eurycea bislineata)*

This species was commonly found in rocky portions of Plum Run (South Confederate Avenue and Devil's Den) at GETT. This type of habitat is ideal for the northern two-lined salamander (Behler and King 1995). It was also found in Sherfy's Woods North at GETT and in Marsh Creek at EISE.

Redback Salamander (*Plethodon cinereus)*

The redback salamander was ubiquitous throughout GETT. Although not documented, it almost certainly occurs in forested areas of EISE. As a group, plethodontids are the most abundant forest salamanders, with densities of up to 10 individuals/m^2 (reviewed in Stebbins and Cohen 1995). Our finding that the redback was the most abundant salamander in this study is consistent with other studies (Burton and Likens 1975; DeGraaf and Yamasaki 1992; Harpole and Haas

1999; Rodewald and Yahner 1999; Mravintz 2000; Ross et al. 2000; Yahner et al. 2001). The redback salamander favors forested habitat (Petranka 1998), but it was also encountered in the Valley of Death meadow at GETT as well.

Red-Spotted Newt (*Notophthalmus viridescens viridescens)*

The red-spotted newt was common at GETT. Only two red efts (the juvenile terrestrial stage) were found: one in Bushman North and one in Little Round Top South. The presence of efts indicates that there is a breeding population in the park. Many adults were also found swimming in Plum Run Valley of Death. No individuals were found in EISE. Juveniles occur in forested habitat, and adults are found in any kind of body of water (Petranka 1998). Because EISE lacks these habitats, the red-spotted newt is unlikely to occur there.

Black Rat Snake (*Elaphe obsoleta obsoleta)*

Although five black rat snakes were encountered only at GETT, this species is probably common in both parks. It has a wide range, which covers almost the entire Commonwealth and occupies a variety of habitats (e.g., forests, fields, swamps) (Behler and King 1995). This snake was noted by chance in forested habitats (n = 2) or on the road (n = 2) and one was captured using a funnel trap in a wetland in the Valley of Death. Two black rat snakes were observed in the Codori-Trostle Thicket at GETT (Van Fleet et al. 1995), and park staff have regularly observed this species at the Hoffman House (Bert Frost, Natural Resource Specialist at GETT, February 2001).

Eastern Garter Snake (*Thamnophis sirtalis sirtalis)*

The eastern garter snake was common at GETT and very likely occurs in EISE. This species was observed at Codori-Trostle Thicket North, Rummel Woods, Granite School House Lane East, McMillan Woods, Spangler Woods, and Plum Run along South Confederate Ave. The garter snake occupies a wide variety of habitats from moist grasslands and woodlands to agricultural and park areas (Behler and King 1995).

Eastern Milk Snake (*Lampropeltis triangulum triangulum)*

The eastern milk snake was uncommon in our study. It is secretive and elusive (Conant and Collins 1998), perhaps explaining why so few were found. This species uses a variety of habitats, including fields, forests, talus slopes, and river bottoms, and is commonly found in barns. During our survey, individuals were found in the maintenance shed (B. Frost, Natural Resource Specialist at GETT, January 2000) and beneath the Crawford Avenue bridge along Plum Run in Valley of Death. A dead milk snake was found south of the Pennsylvania monument grasslands at GETT during the inventorying and monitoring herp protocol project of Yahner et al. (1999) (G. Keller, Research Technologist at the Pennsylvania State University, September 2000). The milk snake likely occurs in EISE, particularly around farm buildings

Northern Ringneck Snake (*Diadophis punctatus edwardsii)*

Three northern ringneck snakes were observed at GETT: Snyder Woods East, Little Round Top, and Burnham Woods/Big Round Top. Because it is the most common snake of upland habitat in Pennsylvania (Hulse 1996), it is probably common in the forested habitats of GETT. The ringneck snake is unlikely to occur in EISE, which consists primarily of agricultural and riparian habitats.

Northern Water Snake (*Nerodia sipedon sipedon)*

This species was common along streams of GETT and is likely found in EISE. Individuals were noted in Willoughby Run and Plum Run/Valley of Death. Multiple sightings occurred in Devil's Den and Barlow's Knoll pond. As the name indicates, this snake species is associated with aquatic habitats (Behler and King 1995).

Common Snapping Turtle (*Chelydra serpentina serpentina)*

This turtle species was common in aquatic habitats with slow-moving water at GETT and EISE. This is a large species, with individuals ranging in size from 10 to 40 cm (carapace length). This turtle species prefers freshwater habitat with mud-covered bottoms and considerable aquatic vegetation (Behler and King 1995).

Eastern Box Turtle (*Terrapene carolina carolina)*

Eastern box turtles were common in forest habitats at GETT; one was also found along Electric Trolley Railbed (S. of Cross Ave.) Wetland, which is a wetland/stream habitat. Forest habitat is preferred by eastern box turtles (Behler and King 1995). Eleven of the 18 encounters were incidental sightings that were not part of a survey protocol. The eastern box turtle likely occurs in EISE as well.

Eastern Painted Turtle (*Chrysemys picta picta)*

The eastern painted turtle was common in aquatic habitats with slow-moving water at GETT and EISE, which is its favored habitat (Behler and King 1995).

Spotted Turtle (*Clemmys guttata)*

The spotted turtle was uncommon at GETT, but no individuals were found at EISE. The three individuals found at GETT were in the Plum Run/Valley of Death. This species can be found in a variety of habitats, provided that it contains aquatic areas (Behler and King 1995).

Common Musk Turtle (*Sternotherus odoratus)*

The common musk turtle was common in open stream habitats of GETT and EISE. This species prefers slow-moving bodies of water with muddy bottoms (Behler and King 1995).

Discussion

An understanding of the biodiversity of amphibians and reptiles in national parks is valuable for many reasons. Forest-management or other practices in a park can have negative effects on amphibian and reptile populations (e.g., deMaynadier and Hunter 1998; Rodewald and Yahner 1999). Woodland salamanders comprise a major portion of the total vertebrate biomass in a terrestrial ecosystem and are important components of the ecosystem (Burton and Likens 1975). These vertebrates are also important components of the food chain. Amphibians (e.g., woodland salamanders) feed on a variety of invertebrates, whereas reptiles (e.g., snakes) feed on both invertebrate and small mammals (Shaffer 1991). Furthermore, there is considerable concern for the decline of amphibian populations (Blaustein and Wake 1990; Fisher and Shaffer 1996, Yahner 2000).

Species Predicted but not Documented During the 1999-2000 Inventory

Jefferson Salamander (*Ambystoma jeffersonianum*)

A Jefferson salamander may have been encountered at Little Round Top North at GETT while conducting a VES in May 1999. However, this individual escaped into a burrow before a positive identification could be made, preventing us from confirming its identity to species.

Although the range of this salamander is widespread throughout Pennsylvania and is found in every county in the state (McCoy 1990), its occurrence is uncommon. However, this species was common along a transmission line right-of-way and adjacent forest in Montgomery County, Pennsylvania (Yahner et al. 2000). The Jefferson salamander is most frequently observed in late winter and early spring around its breeding site, but spends most of its time underground at other times of the year (Petranka 1998). We would have expected to find egg masses of the Jefferson salamander in vernal pools if populations occur in the parks.

Northern Dusky Salamander (*Desmognathus fuscus fuscus*)

The northern dusky salamander is a common species with a widespread range in Pennsylvania (McCoy 1990). It favors streamside habitat (Behler and King 1995). Because our inventory thoroughly surveyed potential habitats, we conclude that the northern dusky salamander does not occur at GETT or EISE.

Long-tailed Salamander (*Eurycea longicauda longicauda*)

This salamander species is common and widespread throughout Pennsylvania (McCoy 1990). It occurs in or along streams (Behler and King 1995), and it may also be found under natural substrate in upland forest areas (Petranka 1998).

A long-tailed salamander was collected in Arendtsville, Adams County, in August 1937. This specimen is kept at the Carnegie Museum of Natural History, Pittsburgh, Pennsylvania. Based on our inventory of potential habitat, we conclude that the long-tailed salamander likely does not presently occur at GETT or EISE.

Northern Spring Salamander (*Gyrinophilus porphyriticus porphyriticus*)

Although the northern spring salamander is found throughout the state, its distribution is spotty. As its name indicates, it is most often found in or along springs and streams (Behler and King 1995).

A northern spring salamander was collected in Caledonia, Adams County, in June 1988. This specimen is kept at the Carnegie Museum of Natural History. Yahner et al. (1999) predicted the occurrence of this species in GETT and EISE based on published range maps. However, the current inventory surveyed potential habitat thoroughly, and we conclude that the northern spring salamander probably does not presently inhabit either park.

Four-toed Salamander (*Hemidactylium scutatum*)

The four-toed salamander has a statewide distribution, but its populations are extremely localized (Hulse 1996). This species prefers fish-free, forested habitat near bogs, swamps, marshes, vernal pools, or similar aquatic areas; they can often be found beneath sphagnum moss in these aquatic habitats (Petranka 1998). Although Yahner et al. (1999) predicted the occurrence of this species in the parks, we believe that the four-toed salamander does not currently occur at GETT or EISE.

Northern Red Salamander (*Pseudotriton ruber ruber*)

The northern red salamander has a statewide distribution (McCoy 1990) and specific habitat preferences, e.g., spring seep or spring-fed bog habitat (Petranka 1998). These habitats are absent (or perhaps very rare) at GETT or EISE.

A northern red salamander was collected from Pine Grove Furnace, Adams County, in June 1989. This specimen is kept at the Carnegie Museum of Natural History, Pittsburgh, Pennsylvania. Yahner et al. (1999) predicted that this species potentially occurs in the parks, but our current inventory surveyed potential habitat thoroughly, suggesting that the northern red salamander does not occur at GETT or EISE.

Northern Cricket Frog (*Acris crepitans crepitans*)

The Piedmont Province is one region in Pennsylvania where the northern cricket frog is primarily found, and GETT and EISE are located in this province. The northern cricket frog prefers to inhabit vegetation surrounding shallow, permanent bodies of water (Behler and King 1995). We suspect that the northern cricket frog does not occur at GETT or EISE because none was found in our thorough search in potential habitat.

Wood Turtle (*Clemmys insculpta*)

Populations of wood turtles are localized in Pennsylvania. The wood turtle has been documented on Wildlife Observation Cards in GETT near East Confederate Avenue on the trail to the 28th Pennsylvania Monument on 16 June 1993 and on Warren Avenue on 6 May 1994. Also, at EISE, it has been documented in a riparian habitat at Marsh Creek by park staff. This turtle occupies forest or grassy habitat in the vicinity of wet areas (Behler and King 1995) and likely also occurs in GETT in low numbers.

A wood turtle was collected from Biglerville, Adams County, in July 1938. This specimen is kept at the Carnegie Museum of Natural History, Pittsburgh, Pennsylvania. Another specimen was collected from Guernsey, Adams County, in July 1944; it is kept at the Smithsonian Institution in Washington, D.C.

Bog Turtle (*Clemmys muhlenbergii*)

The Nature Conservancy (1998) conducted a search for bog turtles in probable habitat at GETT, but found none. At GETT and EISE, aquatic habitat is more vegetated and less muddy compared to documented areas where bog turtles typically occur. They require muddy areas in or near bogs, swamps, and wet meadows (Conant and Collins 1998). Yahner et al. (1999) predicted the occurrence of this species in GETT and EISE based on published range maps. Based on our inventory, however, we conclude that the bog turtle probably does not occur at either park.

Redbelly Turtle (*Pseudemys rubriventris*)

Rock Creek (GETT) and Marsh Creek (EISE) are part of the Potomac drainage, which is cited as a potential place of occurrence for the redbelly turtle (Hulse 1996). This species prefers ponds, lakes, streams, rivers, and brackish marshes (Behler and King 1995).

A redbelly turtle was collected from Fairfield, Adams County, in April 1973. This specimen is stored at the Carnegie Museum of Natural History, Pittsburgh, Pennsylvania. The current inventory surveyed potential habitat thoroughly, and we conclude that the redbelly turtle probably does not occur at GETT or EISE.

Coal Skink (*Eumeces anthracinus*) and Five-lined Skink (*Eumeces fasciatus*)

A skink sighting has been recorded on a Wildlife Observation Card at GETT at the bottom of Houck's Ridge and Devil's Den on 18 August 1993. However, the species of skink was not given in this observation. Coal skinks prefer damp woodlands with much loose, natural substrate on the forest floor (Behler and King 1995). McCoy (1990) describes the distribution of this species as spotty and extremely localized. As with the coal skink, the five-lined skink prefers damp woodlands with an abundance of natural substrate on the forest floor (Behler and King 1995).

We expected to document skinks in general searches in forest habitats but recorded none. If skinks occur in GETT or EISE, they are uncommon or rare.

Northern Fence Lizard (*Sceloporus undulatus hyacinthinus*)

This species generally occupies open areas where it can bask in the sun (Behler and King 1995). Adams County is within the range distribution of the northern fence lizard (McCoy 1990). Fence lizards are elusive and may have been missed by our inventory.

Northern Copperhead (*Agkistrodon contortrix mokason*)

The northern copperhead has been recorded by Art Hulse, herpetologist at the Indiana University of Pennsylvania. It has also been documented on Wildlife Observation Cards in GETT on 21 August 1990 on a trail at Little Round Top and on 22 August 1991 in the middle of Warren Avenue. This snake likes swampy areas or rocky, forested areas near water (Behler and King 1995).
A northern copperhead also was collected in Arendtsville, Adams County, in June 1937. This specimen is kept at the Carnegie Museum of Natural History, Pittsburgh, Pennsylvania. The copperhead was not documented in the current inventory and is likely very uncommon to rare in the parks.

Northern Black Racer (*Coluber constrictor constrictor*)

A northern black racer was observed by Yahner et al. (1999) at GETT. It likes open woodlands, grasslands, and fields (Behler and King 1995). The northern black racer was not documented in the current inventory and is likely uncommon in the parks.

Timber Rattlesnake (*Crotalus horridus*)

A timber rattlesnake sighting was recorded on a Wildlife Observation Card at GETT at Fantasyland on 22 May 1993. The timber rattlesnake is often found in rocky outcrops in forested areas, away from disturbance (Behler and King 1995). In July 1972, a Shippensburg Museum specimen was collected 5 km east of GETT. If rattlesnakes den or overwinter in the parks, it is likely that they would have been documented in the summer, when they are active. We conclude that the rattlesnake does not occur as a resident species in GETT or EISE, but may be observed on occasion.

Eastern Hognose Snake (*Heterodon platirhinos*)

The dead eastern hognose snake has been recorded on a Wildlife Observation Card at GETT on 30 October 1981 at the intersection of Slocum Avenue and Baltimore Pike. The eastern hognose snake occupies a variety of habitats, including upland forests, woodland meadows, agricultural fields, and areas with sandy soils (Behler and King 1995). McCoy (1990) indicates that this species is found in the extreme northern part of Adams County. The eastern hognose snake was not encountered in the current inventory and is probably uncommon to rare in the parks.

Smooth Green Snake (*Opheodrys vernalis vernalis*)

The smooth green snake has a spotty distribution across the state. It is not found in the Coastal Plain or Piedmont Provinces. Therefore, this species does not likely occur at GETT or EISE, although the field habitat of the park is ideal for the smooth green snake (Behler and King 1995). Yahner et al. (1999) predicted that this species could occur in the parks based on published range maps.

Evaluation of Inventory Protocols

Coverboard Protocol

Coverboards primarily target terrestrial salamander species and snakes (Fitch 1992; Droege et al. 1997; Yahner et al. 2001). Six species and 463 total captures were noted via the coverboard protocol (Tables 3, 4, 8). With this protocol, we were able to capture the northern slimy salamander, which is a species not accounted for by other protocols. Coverboards have value in monitoring population trends of abundant species, such as redback salamanders.

Visual-Encounter Survey Protocol

Thirteen species and 528 individual amphibians and reptiles were observed using visual-encounter surveys (VES) (Tables 3, 4, 8). This protocol accounted for the northern ringneck snake, which was not observed using any other protocol. Unlike coverboard surveys, the success of the VES was dependent on the availability of cover objects within the plot that could be overturned for inspection. Hence, for long-term monitoring, coverboards are easier to use in most habitats as artificial substrates or where natural substrates are lacking.

Calling-Survey Protocol

We recorded nine species and 183 herp observations with calling surveys (Tables 3-4). The gray treefrog was encountered only with calling surveys; these surveys provided more data on the distribution of anurans in the parks than other protocols. In many states, this protocol is used for long-term monitoring of anuran population trends (USGS 2000). Although the calling index is subjective and very generalized, it could provide an indication of population size if repeated for many years (Zimmerman 1994).

General-Search Protocol

General searches yielded 22 species and 106 herp observations (Tables 3, 4, 8). The eastern milk snake was observed only by this protocol. This protocol has the advantage of allowing extensive coverage of the parks in a relatively short time period.

Funnel-Trap Protocol

Based on funnel traps, we noted eight species and 18 individual amphibians and reptiles (Tables 3, 4, 8). There were no species documented with this protocol that were not already found using other protocols. One benefit of this protocol was that it provided species documentation from multiple locations, thereby generating more credence to the species list (e.g., black rat snake and common musk turtle were found in Plum Run/Valley of Death at GETT with this protocol). However, this protocol was very labor-intensive, particularly when associated with drift fences, and yielded very few observations per effort. If the other protocols are used, we do not recommend the use of funnel traps in future monitoring or inventory efforts.

Drift-Fence Array Protocol

Four species and eight individual amphibians and reptiles were captured with pitfall traps (Tables 3, 4, 8). No species were caught with this protocol that were not already noted using other protocols. Most species documented using pitfalls were abundant in the parks and found using other protocols and at many other locations (e.g., eastern American toad and spotted salamander). The northern leopard frog was the only exception. It was found in a pitfall trap at Little Round Top, where it was not captured using other protocols, and it was only found in two other locations using the general-search protocol. As with the use of funnel traps, pitfalls were very labor intensive and yielded low capture rates.

Turtle-Trap Protocol

We documented four turtle species and 22 captures using turtle traps (Tables 3, 4, 8). Although turtle traps did not capture species that were not already represented by other survey protocols, they extended our knowledge of the distributions of species and doubled the capture rate of common musk, snapping, and eastern painted turtles. Turtle traps were easy to use and check, but capture success seemed to be variable with time of year and water levels. For example, our greatest capture rates were in June and July, whereas rates in fall were particularly low. High waters and flooding in October resulted in the loss of a few traps and the potential of turtles drowning in the remaining traps.

Inventorying/Monitoring Recommendations

We have prepared instructions for the parks to monitor five 15- x 15-m VES and coverboard sampling areas, which were used in our project. These areas were selected because of high diversity and abundance of amphibians and reptiles during our inventory. This effort will primarily yield long-term trends in redback salamander populations. To monitor aquatic amphibians and reptiles, we suggest surveying streams and wetlands in spring, summer, and fall, and trapping aquatic turtles during the summer. Calling surveys should continue along vehicular routes to provide trends in frog and toad populations.

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Appendix A. Geographic coordinates of sampling points and habitat classification, survey type, and time the surveys were conducted at points at Gettysburg National Military Park and Eisenhower National Historic Site, 1999-2000. Coordinates are in UTM Zone 18N, NAD1983.

Site	UTM-East	UTM-North	Description	Classification	Survey Type and Time Conducted
1	309970.83	4410415.81	East Confederate Ave 2nd bridge	Stream	CS (1999, 2000)
2	310259.05	4409505.41	E. Confederate Ave Spangler's Spring	Wetland/Stream	CS (1999, 2000)
3	309148.76	4413221.48	Barlow's Knoll Pond from Farmhouse	Pond	CS (1999, 2000)
4	307526.69	4412613.30	Buford Ave corner	Wetland/Stream	CS (1999, 2000)
5	307265.82	4412057.20	Meredith Ave McPherson Quarry	Pond	CS (1999, 2000)
6	307105.79	4411803.56	Meredith Ave Indiana Monument	Stream	CS (1999, 2000)
7	307362.70	4410436.23	West Confederate Ave Youth Camp	Wetland	CS (1999, 2000)
8	307110.95	4409183.68	West Confederate Ave 2nd Bridge	Stream	CS (1999, 2000)
9A	305553.52	4407215.00	Red Rock Road driveway/bridge	Stream	CS (1999, 2000)
9B	305140.76	4407405.80	Marsh Creek from farmfield	Wetland/Stream	CS (1999, 2000)
10	307705.89	4406301.37	South Confederate Ave Plum Run	Stream	CS (1999, 2000)
11	308333.58	4407543.28	Crawford Ave Plum Run	Wetland/Stream	CS (1999, 2000)
12	308093.76	4407037.71	Crawford Ave Devils Den	Wetland/Stream	CS (1999, 2000)
13	307694.40	4407270.13	Ayers Ave bridge	Wetland/Stream	CS (1999, 2000)
14	308142.39	4408141.96	US Ave Plum Run	Wetland/Stream	CS (1999, 2000)
15	308585.72	4408855.20	Hancock Ave PA Monument	Wetland/Stream	CS (1999, 2000)
16	309340.62	4409131.31	Middle Fantasyland Pond	Pond	CS (1999, 2000)
17	309199.52	4409565.05	Hunt Ave Fantasyland Pond	Pond	CS (1999, 2000)
18	314583.07	4410826.78	East Cavalry Field	Wetland/Stream	CS (2000)
L1	306676.97	4409112.95	Pitzer Woods	Forest	VES (1999, 2000)

Appendix A, continued.

Site	UTM-East	UTM-North	Description	Classification	Survey Type and Time Conducted
L10	307899.62	4406702.20	Snyder Woods West	Forest	VES (1999, 2000)
L11	308088.24	4406887.11	Snyder Woods East	Forest	VES (1999, 2000)
L12	308306.70	4408583.84	Codori-Trostle Thicket North	Forest	VES (1999, 2000)
L14	308750.17	4407730.59	Sedgwick Ave	Forest	VES, FT (1999); VES (2000)
L16	309501.79	4408615.67	Granite School House Lane West	Forest	VES (1999, 2000)
L17	314403.10	4412086.68	Rummel Woods	Forest	VES (1999, 2000)
L19	307445.15	4405928.04	Bushman Woodlot South	Forest	VES, FT (1999); VES (2000)
L2	306780.94	4407406.56	Biesecker Woods North	Forest	VES (1999, 2000)
L23	308215.26	4408396.72	Codori-Trostle Thicket South	Forest	VES (1999, 2000)
L3	306800.12	4407215.08	Biesecker Woods South	Forest	VES (1999, 2000)
L30	307721.76	4407415.94	Sherfy Woods North	Forest	VES (1999, 2000)
L31	309197.14	4409000.48	Guinn Woods	Forest	VES (1999, 2000)
L32	309686.73	4408602.61	Granite School House Lane East	Forest	VES (1999, 2000)
L33	310358.92	4410086.35	Culp’s Hill East	Forest	VES (1999, 2000)
L4	307305.97	4410526.42	McMillan Woods	Forest	VES (1999, 2000)
L5	307199.51	4409198.12	Spangler Woods	Forest	VES (1999, 2000)
L8	307693.76	4405996.78	Bushman Woodlot East	Forest	VES (1999)
L9	307576.62	4406984.72	Sherfy Woods South	Forest	VES (1999, 2000)
U1	307507.94	4406123.39	Bushman Woodlot North	Forest	VES (1999, 2000)
U10	308602.48	4407001.69	Little Round Top North	Forest	VES (1999, 2000)
U2	307998.87	4406302.83	Big Round Top West	Forest	VES (1999, 2000)
U3	308200.04	4406504.20	Big Round Top East	Forest	VES (1999, 2000)
U4	308632.05	4406831.97	Little Round Top South	Forest	VES, FT (1999); VES (2000)
U5	310215.67	4409731.82	Culp’s Hill South	Forest	VES, FT (1999); VES (2000)
U6	310093.68	4410215.92	Culp’s Hill West	Forest	VES (1999, 2000)

Appendix A, continued.

Site	UTM-East	UTM-North	Description	Classification	Survey Type and Time Conducted
U8	309915.06	4408601.18	Powers Hill	Forest	VES, FT (1999); VES (2000)
G1	308599.69	4408321.68	Pennsylvania Monument West	Forest	CB, FT (1999); CB (2000)
G2	308817.13	4408343.65	Pennsylvania Monument East	Forest	CB (1999, 2000)
G3	307852.28	4408018.12	Wheatfield West	Forest	CB (2000)
G4	308293.97	4407911.36	Wheatfield East	Forest	CB, FT (1999); CB (2000)
G5	305518.63	4407309.65	Red Rock Road	Forest	CB, FT (1999)
G6	308934.51	4408998.99	Biggs East	Forest	CB, FT (1999); CB (2000)
G7	308725.01	4409004.02	Biggs West	Forest	CB (1999, 2000)
R1	305223.84	4407512.14	Marsh Creek - EISE	Riparian	VES, TT (1999); TT, LB, GS (2000)
R4	307057.27	4411752.92	Willoughby Run North	Riparian	VES, FT, TT (1999); LB, GS (2000)
R5	310410.08	4409662.64	Rock Creek	Riparian	VES, FT, TT (1999); TT, LB (2000)
R6	307495.10	4409802.38	Tributary West Confederate	Stream	VES (1999, 2000)
R7	307774.74	4406302.26	Plum Run South Confederate Ave	Stream	VES (1999); VES, LB, GS (2000)
R8	307906.73	4406873.35	Devil's Den	Stream	VES (1999); VES, LB, GS, PO (2000)
R9	305787.06	4407861.98	Willoughby Run South	Stream	FT, TT (1999); TT (2000)
W17	309342.43	4409138.53	Middle Fantasyland Pond	Pond	TT (1999); GS (2000)
W2	309315.63	4413143.47	Barlow’s Knoll pond	Pond	EM (1999); TT, LB, GS (2000)
W4	307276.28	4412058.26	McPherson Quarry	Pond	EM (1999); TT, LB, GS (2000)
W19	314374.44	4410255.31	East Cavalry Field stream and pond	Pond/Stream	GS (2000)
W1	309246.01	4409065.21	Guinn Woods Pools	Vernal Pool	EM (1999); GS, PO (2000)
W10	310422.72	4409718.63	Rock Creek Pools South	Vernal Pool	EM (1999); GS, PO (2000)
W11	309785.16	4408471.54	Granite School House Lane Pools	Vernal Pool	EM (1999); GS (2000)
W12	305144.14	4407432.86	Marsh Creek Pools	Vernal Pool	EM (1999); GS (2000)

Appendix A, continued.

Site	UTM-East	UTM-North	Description	Classification	Survey Type and Time Conducted
W15	307731.60	4407321.48	Electric Trolley Railbed (N. of Cross Ave.) Pools	Vernal Pool	EM (1999); GS (2000)
W3	307601.84	4406375.11	S. Confederate Ave. (Wells Monument) Culvert	Vernal Pool	EM (1999); GS, PO (2000)
W9	310406.27	4410101.63	Rock Creek Pools North	Vernal Pool	EM (1999); GS (2000)
W13	307289.87	4410483.50	McMillan Woods Wetland	Wetland	EM (1999); GS (2000)
W21	307865.86	4406839.62	West of Devil's Den	Wetland	VES, GS (2000)
W14	307765.75	4407103.54	Electric Trolley Railbed (S. of Cross Ave.) Wetland	Wetland/Stream	FT, EM (1999); GS, PO (2000)
W16	308304.15	4408503.31	Codori-Trostle Thicket Wetland	Wetland/Stream	EM (1999); GS (2000)
W18	306146.62	4407152.47	Nine-acre Pasture - EISE Stream	Wetland/Stream	GS (2000)
W20	307156.72	4412876.72	Will’s / Winebrenner Farm	Wetland/Stream	TT, GS, PO (2000)
W5	308342.39	4407407.25	Plum Run/Valley of Death	Wetland/Stream	TT, FT, EM (1999); GS, PO (2000)
W6	308166.87	4408081.13	Althoff-Weikert Pond	Wetland/Stream	EM (1999); TT, LB, GS, PO (2000)
W7	308167.69	4408162.01	Codori-Trostle Thicket / U.S. Ave. Pools	Wetland/Stream	EM (1999); GS (2000)
W8	308546.46	4408825.54	Codori-Trostle Pasture / PA Monument Pools	Wetland/Stream	EM (1999)
TRAPW5	308371.49	4407317.68	Wetland Trap Array (Valley of Death)	Wetland	DF (2000)
TRAPU4	308686.71	4406833.16	Forest Trap Array (Little Round Top)	Forest	DF (2000)
TRAPG6	308942.69	4408929.34	Grassland Trap Array (Biggs Field)	Grassland	DF (2000)

Appendix B. Dates that sampling points were inventoried for amphibians and reptiles using funnel traps at Gettysburg National Military Park and Eisenhower National Historic Site, 1999-2000.

Date	Points of Funnel Trap Placement
6/7/99 - 6/9/99	Horse Trail
	G5
	W5
	G6
	R5
	U8
	R4
	W14
	L19
7/12/99 - 7/15/99	R5
	U5
	U8
	R4
	W14
	W5
	G6
	G1
9/17/99 - 9/19/99	R5
	W5
	L14
10/8/99 - 10/10/99	R9
	R4
	W5
	G4
	U4

Appendix C. Dates that sampling points were inventoried for turtles using turtle traps at Gettysburg National Military Park and Eisenhower National Historic Site, 1999-2000.

Date	Points Trapped for Turtles
7/12/99 - 7/15/99	R1
	R5
	W17
	W5
9/17/99 - 9/19/99	W5
	W17
	R5
	R9
10/8/99 - 10/10/99	R4
	W17
	W5
	R9
4/10/00 - 4/14/00	W2
	W6
	W4
5/15/00 - 5/18/00	W4
	W6
	W2
	R9
6/27/00 - 6/29/00	W6
	W20
	W2
	W4
7/24/00 - 7/26/00	W20
	R5
	R1

Appendix D. Documented amphibians and reptiles having an associated voucher photo on file with the Gettysburg National Military Park resource management staff.

Site	Site Description	Date	Protocol	Age
Species				
Black Rat Snake (*Elaphe obsoleta obsoleta*)				
	South Confederate Ave. along road	07/16/1999	General Search	Adult
Bullfrog (*Rana catesbeiana*)				
R4	Willoughby Run North	04/11/2000	General Search	Adult
Common Musk Turtle (*Sternotherus odoratus*)				
R9	Willoughby Run South	05/18/2000	Turtle Trap	Adult
W5	Plum Run/Valley of Death	07/14/1999	Funnel Trap	Juvenile
Common Snapping Turtle (*Chelydra serpentina serpentina*)				
R9	Willoughby Run South	05/16/2000	Turtle Trap	Adult
W17	Middle Fantasyland Pond	07/15/1999	Turtle Trap	Adult
W5	Plum Run/Valley of Death	07/15/1999	Turtle Trap	Adult
W6	Althoff-Weikert Pond	05/16/2000	General Search	Adult
Eastern American Toad (*Bufo americanus americanus*)				
IX3[1]	Insect sampling site Big Round Top	06/21/1999	General Search	Adult
TRAPU4	Forest Trap Array (Little Round Top)	06/28/2000	Pitfall	Juvenile
Eastern Box Turtle (*Terrapene carolina carolina*)				
IX1[1]	Insect sampling site Big Round Top	06/23/1999	General Search	Adult
L10	Snyder Woods West	10/11/1999	VES	Adult
L10	Snyder Woods West	10/11/1999	VES	Adult
U3	Big Round Top East	09/19/1999	VES	Adult
Eastern Garter Snake (*Thamnophis sirtalis sirtalis*)				
L4	McMillan Woods	09/18/1999	Coverboard	Adult
L5	Spangler Woods	09/18/1999	VES	Adult
Eastern Milk Snake (*Lampropeltis triangulum*)				
W5	Plum Run/Valley of Death	05/18/2000	General Search	Adult
Eastern Painted Turtle (*Chrysemys picta picta*)				
W17	Middle Fantasyland Pond	07/15/1999	Turtle Trap	Adult
W2	Barlow's Knoll pond	06/28/2000	Turtle Trap	Adult
W2	Barlow's Knoll pond	06/28/2000	Turtle Trap	Adult

Appendix D, continued.

Species Site	Site Description	Date	Protocol	Age
Eastern Painted Turtle (*Chrysemys picta picta*)				
W2	Barlow's Knoll pond	06/28/2000	Turtle Trap	Adult
W5	Plum Run/Valley of Death	07/15/1999	Turtle Trap	Adult
Green Frog (*Rana clamitans melanota*)				
TRAPU4	Forest Trap Array (Little Round Top)	06/28/2000	Pitfall	Juvenile
W3	S. Confederate Ave. (Wells Monument) Culvert	04/12/2000	General Search	Adult
W5	Plum Run/Valley of Death	07/15/1999	Funnel Trap	Juvenile
Northern Leopard Frog (*Rana pipiens*)				
IS7[1]	Insect sampling site Codori-Trostle	08/10/1999	General Search	Adult
TRAPU4	Forest Trap Array (Little Round Top)	06/29/2000	Pitfall	Juvenile
W5	Plum Run/Valley of Death	07/16/1999	General Search	Adult
Northern Ringneck Snake (*Diadophis punctatus edwardsii*)				
IZ1[1]	Insect sampling site Big Round Top	06/23/1999	VES	Adult
Northern Slimy Salamander (*Plethodon glutinosus*)				
U10	Little Round Top North	09/19/1999	Coverboard	Adult
Northern Two-lined Salamander (*Eurycea bislineata*)				
R7	Plum Run South Confederate Ave	11/12/1999	VES	Adult
R7	Plum Run South Confederate Ave	04/12/2000	VES	Adult
Northern Water Snake (*Nerodia sipedon sipedon*)				
R8	Devil's Den	04/12/2000	VES	Adult
W5	Plum Run/Valley of Death	07/16/1999	General Search	Adult
Pickerel Frog (*Rana palustris*)				
R6	Tributary West Confederate	04/11/2000	VES	Adult
R7	Plum Run South Confederate Ave	11/12/1999	VES	Adult
W5	Plum Run/Valley of Death	07/16/1999	General Search	Adult
Redback Salamander (*Plethodon cinereus*)				
TRAPW5	Wetland Trap Array (Valley Death)	04/12/2000	Funnel Trap	Adult
U10	Little Round Top North	09/19/1999	Coverboard	Adult
U4	Little Round Top South	03/18/2000	VES	Adult

Appendix D, continued.

Species Site	Site Description	Date	Protocol	Age
Redback Salamander (*Plethodon cinereus*)				
U6	Culp's Hill West	09/18/1999	VES	Adult
Red-spotted Newt (*Notophthalmus viridenscens*)				
U4	Little Round Top South	03/18/2000	Coverboard	Juvenile
W5	Plum Run/Valley of Death	03/18/2000	General Search	Adult
Spotted Salamander (*Ambystoma maculatum*)				
TRAPU4	Forest Trap Array (Little Round Top)	06/28/2000	Pitfall	Juvenile
TRAPU4	Forest Trap Array (Little Round Top)	06/29/2000	Funnel Trap	Juvenile
TRAPU4	Forest Trap Array (Little Round Top)	06/29/2000	Funnel Trap	Juvenile
TRAPU4	Forest Trap Array (Little Round Top)	07/25/2000	Pitfall	Juvenile
U10	Little Round Top North	10/09/1999	VES	Adult
U10	Little Round Top North	11/11/1999	VES	Adult
U6	Culp's Hill West	09/18/1999	Coverboard	Adult
W5	Plum Run/Valley of Death	03/09/2000	General Search	Egg
Spotted Turtle (*Clemmys guttata*)				
W5	Plum Run/Valley of Death	10/10/1999	Turtle Trap	Adult
Wood Frog (*Rana sylvatica*)				
W14	Electric Trolley Railbed (S. of Cross Ave.) Wetland	03/18/2000	General Search	Egg
W5	Plum Run/Valley of Death	03/18/2000	General Search	Egg

[1]For a description of these insect sampling sites, see Kim, K.C., K.L. Derge, J. Grehan, and R.P. Withington III. 2001. Inventory of invertebrates at Gettysburg National Military Park and Eisenhower National Historic Site, with special reference to forest removal. National Park Service, Technical Report. NPS/PHSO/NRTR-XX/XXX.

Appendix E. Mean (± *SE*) of variables measured during visual-encounter and coverboard surveys for amphibians and reptiles at Gettysburg National Military Park, 1999-2000. Abundance is defined as the total number of individuals documented during a single visit; person-hours is the amount of time surveyed times the number of surveyors; objects is the number of logs, rocks, and coverboards turned in a survey; and relative abundance is the abundance divided by the number of objects.

Site	Abundance of Redback Salamander	Person-hours Surveyed	Number of Objects Turned	Relative Abundance Redback Salamander
L1	0.44 ± 0.24	0.15 ± 0.02	62.1 ± 8.8	0.01 ± 0.01
L10	2.22 ± 0.72	0.21 ± 0.03	53.9 ± 9.2	0.04 ± 0.01
L11	1.22 ± 0.32	0.27 ± 0.03	103.6 ± 13.7	0.02 ± 0.01
L12	0.00 ± 0.00	0.14 ± 0.02	49.8 ± 5.4	0.00 ± 0.00
L14	0.22 ± 0.22	0.14 ± 0.01	52.7 ± 4.7	0.00 ± 0.00
L16	7.33 ± 2.40	0.20 ± 0.01	58.0 ± 7.3	0.13 ± 0.04
L17	13.00 ± 1.86	0.31 ± 0.04	78.9 ± 5.2	0.17 ± 0.02
L19	0.33 ± 0.24	0.14 ± 0.02	43.7 ± 6.3	0.01 ± 0.00
L2	2.44 ± 0.69	0.16 ± 0.01	61.3 ± 5.5	0.04 ± 0.01
L23	0.11 ± 0.11	0.11 ± 0.02	25.4 ± 2.2	0.00 ± 0.00
L3	2.11 ± 0.35	0.15 ± 0.01	52.6 ± 3.7	0.04 ± 0.01
L30	1.00 ± 0.33	0.15 ± 0.02	34.0 ± 3.7	0.03 ± 0.01
L31	4.22 ± 0.70	0.19 ± 0.01	48.4 ± 3.7	0.08 ± 0.01
L32	4.67 ± 1.03	0.22 ± 0.02	68.4 ± 8.2	0.06 ± 0.01
L33	0.44 ± 0.34	0.11 ± 0.01	38.4 ± 3.8	0.01 ± 0.01
L4	8.44 ± 2.42	0.11 ± 0.01	33.0 ± 3.1	0.24 ± 0.06
L5	1.33 ± 0.37	0.16 ± 0.02	62.0 ± 7.0	0.02 ± 0.01
L8	2.60 ± 1.25	0.13 ± 0.02	41.8 ± 4.5	0.07 ± 0.04
L9	0.78 ± 0.36	0.14 ± 0.01	58.7 ± 7.5	0.01 ± 0.01
U1	0.67 ± 0.55	0.19 ± 0.02	51.3 ± 5.1	0.01 ± 0.01
U10	12.67 ± 3.27	0.31 ± 0.04	74.2 ± 10.9	0.18 ± 0.04
U2	1.56 ± 0.56	0.20 ± 0.02	74.4 ± 10.7	0.02 ± 0.01
U3	1.22 ± 0.60	0.28 ± 0.02	106.9 ± 9.8	0.01 ± 0.00
U4	11.56 ± 2.64	0.30 ± 0.02	73.7 ± 7.7	0.15 ± 0.02
U5	4.22 ± 1.65	0.19 ± 0.02	53.0 ± 5.2	0.08 ± 0.03
U6	8.00 ± 1.99	0.38 ± 0.05	119.7 ± 10.8	0.06 ± 0.01
U8	5.11 ± 1.07	0.22 ± 0.02	90.4 ± 11.3	0.06 ± 0.02

Appendix F. Species of herbaceous plants observed in plots (n = 24) associated with coverboard and visual-encounter surveys at Gettysburg National Military Park and Eisenhower National Historic Site, 1999-2000.

Common Name	**Scientific Name**
American Lopseed	*Phryma leptostachya*
Avens	*Geum* spp.
Beard-tongue	*Penstamon* spp.
Bedstraw	*Galium* spp.
Creeping-jenny	*Lysimachia nummularia*
Enchanter's Nightshade	*Circaea* spp.
Feathery False Solomon's-seal	*Smilacina racemosa*
Garlic-mustard	*Alliaria officinalis*
Goldenrod	*Solidago* spp.
Ground Ivy	*Glechoma hederacea*
Harvestlice	*Agrimonia parviflora*
Jack-in-the-pulpit	*Arisaema triphyllum*
Japanese Stilt Grass	*Microstegium vimineum*
Liverleaf	*Hepatica americana*
Mild Water-pepper	*Polygonum hydropiper*
Rough Avens	*Geum laciniatum*
Rue Anemone	*Anemonella thalictroides*
Small-spike False Nettle	*Boehmeria cylindrica*
Tick Trefoil	*Desmodium* spp.
Violet	*Viola* spp.
Virginia Knotweed	*Tovara virginiana*
Wild Comfrey	*Cynoglossum virginianum*
Wood Sorrel	*Oxalis* spp.
Woodland Strawberry	*Fragaria vesca*

Appendix G. Species of woody seedlings observed in plots (n = 28) associated with coverboard and visual-encounter surveys at Gettysburg National Military Park and Eisenhower National Historic Site, 1999-2000.

Common Name	**Scientific Name**
American Elm	*Ulmus americana*
Black Cherry	*Prunus serotina*
Black Tupelo	*Nyssa sylvatica*
Blackberry/Raspberry	*Rubus* spp.
Blueberry	*Vaccinium* spp.
Common Hackberry	*Celtis occidentalis*
Downy Serviceberry	*Amelanchier arboria*
Eastern Hop-hornbeam	*Ostrya virginiana*
Eastern Poison-ivy	*Toxicodendron radicans*
Flowering Dogwood	*Cornus florida*
Gooseberry	*Ribes* spp.
Grape	*Vitis* spp.
Hickory	*Carya* spp.
Japanese Barberry	*Berberis thunbergii*
Japanese Honeysuckle	*Lonicera japonica*
Northern Red Oak	*Quercus rubra*
Northern Spicebush	*Lindera benzoin*
Northern White Oak	*Quercus alba*
Pignut Hickory	*Carya glabra*
Rambler Rose	*Rosa multiflora*
Red Maple	*Acer rubrum*
Redbud	*Cercis canadensis*
Sassafras	*Sassafrass albidum*
Smooth Blackhaw	*Viburnum prunifolium*
Sweet Cherry	*Prunus avium*
Tree-of-heaven	*Ailanthus altissima*
Virginia Creeper	*Parthenocissus quinquefolia*
White Ash	*Fraxinus americana*

Appendix H. Species of saplings and shrubs observed in plots (n = 42) associated with coverboard and visual-encounter surveys at Gettysburg National Military Park and Eisenhower National Historic Site, 1999-2000.

Common Name	**Scientific Name**
American Bittersweet	*Celastrus scandens*
American Elm	*Ulmus americana*
American Witch-hazel	*Hamamelis virginiana*
Arrow-wood	*Viburnum recognitum*
Autumn-olive	*Elaeagnus umbellata*
Bitternut Hickory	*Carya cordiformis*
Black Cherry	*Prunus serotina*
Black Oak	*Quercus velutina*
Black Tupelo	*Nyssa sylvatica*
Black Walnut	*Juglans nigra*
Blackberry / Raspberry	*Rubus* spp.
Blueberry	*Vaccinium* spp.
Chestnut Oak	*Quercus prinus*
Common Hackberry	*Celtis occidentalis*
Downy Serviceberry	*Amelanchier arboria*
Eastern Hop-hornbeam	*Ostrya virginiana*
Eastern Red-cedar	*Juniperus virginiana*
Flowering Dogwood	*Cornus florida*
Gooseberry	*Ribes* spp.
Greenbrier	*Smilax glauca*
Japanese Barberry	*Berberis thunbergii*
Japanese Honeysuckle	*Lonicera japonica*
Maple-leaf Arrow-wood	*Viburnum acerifolium*
Mockernut Hickory	*Carya tomentosa*
Northern Red Oak	*Quercus rubra*
Northern Spicebush	*Lindera benzoin*
Northern White Oak	*Quercus alba*
Osage-orange	*Maclura pomifera*
Pignut Hickory	*Carya glabra*

Appendix H, continued.

Common Name	**Scientific Name**
Rambler Rose	*Rosa multiflora*
Red Maple	*Acer rubrum*
Redbud	*Cercis canadensis*
Sassafras	*Sassafrass albidum*
Shag-bark Hickory	*Carya ovata*
Slippery Elm	*Ulmus rubra*
Smooth Blackhaw	*Viburnum prunifolium*
Sweet Cherry	*Prunus avium*
Tree-of-heaven	*Ailanthus altissima*
Tuliptree	*Liriodendron tulipifera*
Virginia Creeper	*Parthenocissus quinquefolia*
White Ash	*Fraxinus americana*
White Mulberry	*Morus alba*

Appendix I. Species of overstory trees observed in plots (n = 25) associated with coverboard and visual- encounter surveys at Gettysburg National Military Park and Eisenhower National Historic Site, 1999-2000.

Common Name	**Scientific Name**
American Elm	*Ulmus americana*
Black Cherry	*Prunus serotina*
Black Oak	*Quercus velutina*
Black Tupelo	*Nyssa sylvatica*
Chestnut Oak	*Quercus prinus*
Eastern Hop-hornbeam	*Ostrya virginiana*
Eastern Red-cedar	*Juniperus virginiana*
Eastern White Pine	*Pinus strobus*
Grape	*Vitis* spp.
Hickory	*Carya* spp.
Mockernut Hickory	*Carya tomentosa*
Northern Red Oak	*Quercus rubra*
Northern White Oak	*Quercus alba*
Pignut Hickory	*Carya glabra*
Red Maple	*Acer rubrum*
Redbud	*Cercis canadensis*
Sassafras	*Sassafrass albidum*
Scarlet Oak	*Quercus coccinea*
Shag-bark Hickory	*Carya ovata*
Shellbark Hickory	*Carya laciniosa*
Slippery Elm	*Ulmus rubra*
Smooth Blackhaw	*Viburnum prunifolium*
Sweet Cherry	*Prunus avium*
Tuliptree	*Liriodendron tulipifera*
White Ash	*Fraxinus americana*